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THE TREND OF THE RACE

A STUDY OF PRESENT TENDENCIES IN THE BIOLOGICAL DEVELOPMENT OF CIVILIZED MANKIND

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PREFACE

THE present volume is the outgrowth of a course of lectures on Eugenics which has been given for several years in the University of California. Its aim is to present an account of the various forces which are at present modifying the inherited qualities of civilized mankind. In dealing with so extensive and complex a subject I have doubtless committed a number of errors and have probably not altogether escaped from being misled by statistical fallacies into which I have so often accused others of having fallen. The more extensively I have delved into the varied literature on the biological evolution of man, the more I have become impressed with the necessity of employing extreme caution in drawing conclusions. Few subjects, in fact, present so many pitfalls for the unwary. It is with the conviction that it is especially important in this field to be sure one is right before going ahead that I have devoted so much effort to critical analysis at the risk of becoming tedious to the general reader.

I am indebted to my colleagues Professor F. B. Sumner and Professor F. J. Teggart for reading my original manuscript and for making a number of valuable suggestions.

The preparation of the present work has involved the compilation of an extensive bibliography which is to be published as an additional volume so that the references may be rendered available for other investigators.

S. J. HOLMES

Berkeley, Calif.
Jan. 1921.

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THE TREND OF THE RACE

CHAPTER I

AN INTRODUCTORY ORIENTATION

"It is the paradox and tragedy of high civilization that, in the present and in all preceding ages, its tendency has been to destroy or eliminate just those mental superiorities by which it has been built up and which are essential for its maintenance and further progress."—Wm. McDougall, *Eugenics Rev.* 5, 297.

In any discussion of the biological evolution of man it is essential to distinguish clearly between changes in the hereditary qualities of human beings and changes in what human beings owe to the environment and institutions under which they live. The latter are matters of what Prof. Baldwin has called social heredity as distinguished from the heredity which has its physical basis in the germ plasm. Man's physical and social heredity while easily distinguished, at least theoretically, have very intimate relations. It is obvious that social heredity is largely dependent upon the innate qualities of men. No civilization could possibly be supported by creatures with the inheritance of the anthropoid apes, and it might happen that civilization would not long endure among people no higher than the lowest races of mankind. The innate endowments of races constitute a basic factor conditioning the nature of every type of civilization and every historic movement, although we may not be able to trace the precise way in which their effects are wrought out in the complex relations of human society.

If the social heredity of man depends largely on his biological heredity, the latter in turn may be profoundly influenced by the kind of social environment under which men live. Those who accept the Lamarckian theory that acquired characteristics may

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be transmitted to the next generation, naturally hold that man's inherited traits can be modified through experiences with his social environment. In the writings of Mr. Herbert Spencer, for instance, most of the peculiarly social endowments of human beings are explained as due to the cumulative inherited effects of the experience of men with their fellows. Human nature through such a process came to be moulded into conformity with the needs of social life, and in the course of time the adjustment, it was supposed, would become more and more nearly complete.

If, however, as most biologists now believe, acquired characters are not transmitted to offspring, the social environment nevertheless is able to influence human heredity in many ways. It may determine to a large extent what kinds of variations survive and propagate, and it may also determine, to some degree at least, the nature of the heredity variations which arise in the germ plasm. Whatever forces have been concerned in the evolution of plant and animal life doubtless continue to operate in the human species. Much still remains to be learned, however, in regard to the factors of evolution in the organic world. The subject is still steeped in controversy. Opinion among biologists remains undecided as to the potency of natural selection, the Lamarckian factor, orthogenesis, isolation and mutation as causes of evolution. And he who would throw the most light on the problems of human biological evolution would perhaps labor most effectively by directing his attention to the lower organisms where it is possible to apply rigidly controlled experimental methods.

But greatly as problems of human evolution would be illuminated by a knowledge of the way in which evolution has been brought about in organisms below man, there would remain a multitude of specifically human evolutionary problems which can be solved only by the study of human data. The development of civilization has brought mankind under influences which have never before come into play. In addition to the natural forces to which lower organisms are exposed, man has come to live in a social *milieu* which constitutes a very large part of what may be called his effective environment. From this circumstance have

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arisen various selective agencies which tend to favor or reduce the prevalence of certain types of inherited traits according to the nature of the institutions that occur at any particular time and place. The first systematic discussion of those agencies forms the subject-matter of Lapouge's *Les Sélections Sociales* (1896), a work which, although not very critical, has had a considerable influence in stimulating the study of selection in man. Lapouge has described the operation of several forms of social selection, *i. e.*, military, political, religious, moral, legal, economic and systematic, all of which are brought into play as a consequence of the development of civilization. Military selection, according to the author, eliminates the best of the race; political selection, through the effects of civil war, the prison, the scaffold, and exile, gets rid of the more independent spirits and tends thereby to render the population submissive and tractable; religious selection, through the celibacy of the clergy and by persecution, tends to effect the elimination of the more intelligent and independent minds; moral and legal selection in general produce dysgenic effects; and economic selection, while operating in many different ways, acts, on the whole, in the most destructive manner upon the superior elements of the race. As civilization becomes more advanced the evil effects of the various forms of social selection become more intense. The racial influence of civilization is therefore bad. Progress may be achieved in science, art, literature and in the development of institutions, but this carries with it the seeds of its own destruction. The relatively feeble force of natural selection which still operates on human beings is powerless to stay the havoc which is being wrought by the selective agencies which result from the development of civilization.

Such, in brief, is the rather sombre prospect which Lapouge has held up to our view. There is only one way by which these destructive forces may be overcome, and that is by conscious, systematic selection, or, as we should now call it, eugenics; but Lapouge is not sanguine over the prospect that human beings will ever bring themselves to supply this remedy in a really effective manner.

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Most readers will instinctively shrink from accepting conclusions of so disquieting a nature. The world has long been familiar with the doctrine that civilizations, after attaining the flower of their development, tend to decay and lapse into relative barbarism. Nations like individuals have been supposed to have their periods of birth, growth and natural death. But, although they have risen and fallen, the torch of progress has been handed on from one to another. Other nations came to the fore out of the great sea of humanity to take advantage of the knowledge and achievements of decadent peoples, and thus humanity has, on the whole, advanced. It might naturally be supposed that this process could be continued without assignable limits, and that, although nations now in the van of progress may lapse into decay, like the great empires of the past, they will be superseded by more virile peoples who will carry achievement to still greater heights.

Were this true, we might be reconciled to national decadence, reflecting that it formed an incident in the general progressive development of humanity. But can this process continue? If the decadence of civilization were merely a social phenomenon, occurring without reference to the hereditary qualities of men, it would be of relatively minor significance in regard to our general biological evolution. If, on the other hand, it means the extinction of relatively superior types of human inheritance its evolutionary significance is indeed serious. We cannot assume that the course of progressive evolution will go smoothly on despite the vicissitudes of our social and political institutions. Degeneration in the organic world has taken place with such remarkable frequency that its occurrence in any group is a contingency to be looked upon as distinctly possible, if not probable. We have degenerate Protozoa, degenerate cœlenterates, degenerate worms, echinoderms, molluscs, crustaceans, arachnids, insects and vertebrates. Whole groups such as the cestodes, nematodes, and Acanthocephali bear the unmistakable signs of descent from more highly organized animals. Parallel illustrations are furnished in abundance among plants. Everywhere the nemesis of degeneracy

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hangs threateningly over the organic world. The attainment of any degree of complexity or perfection of organization is no guaranty against deterioration. There is not the slightest ground for believing that man himself is in any degree shielded from its insidious influence. In fact, it is not improbable that many existing peoples have descended from ancestors who were more favored with natural gifts, and we should bear in mind the possibility that our own civilization may become one with Nineveh and Tyre.

If human progress involves the successive exhaustion of the best blood of those nations which gain the ascendency in the development of culture, it can scarcely lead to any other result than a general deterioration of the human species. If there have always been races of superior inheritance, such as those of Nordic stock, which have remained upon a relatively low cultural level, and which were capable of acquiring the civilization of the decadent nations which they supplanted, it by no means follows that the human species will always be so favorably situated. Mr. Seth Humphrey has recently drawn attention to the "exhaustion of reserves" which are at present available for carrying on the work of civilization. Of all our national resources the most important is our supply of men of superior stock. And we are approaching a period in which the problem of the conservation of this resource is becoming more and more pressing.

The biological situation of our race is at present in many respects unique. In the earlier stages of man's evolution development was mainly along divergent lines. The spread of mankind over the continents and islands of the globe brought about the formation of more or less completely isolated stocks, subjected to different conditions of environment. This resulted in breaking up the human species into a great multitude of divergent groups, in a manner which closely parallels the diversification of species of plants and animals subjected to the combined influence of isolation and varied surroundings. Few species of organisms present so great a variety of hereditarily diverse strains as our own. And even if we divide *Homo sapiens* into several distinct species,

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the same statement would apply to each of the component groups.

But now the trend of racial development has changed. Barriers that formerly kept peoples apart have become broken down. Races are meeting and amalgamating at a rate which becomes more rapid as time goes on and facilities for travel and intercommunication increase. The diversities which were the product of the long period of man's earlier evolution are becoming rapidly submerged. The period of divergence is now superseded by a period of convergence which, if it does not involve the ultimate obliteration of our present distinctions of race, will certainly greatly diminish the number of separate ethnic stocks. Perhaps the final result, if we can speak of any result as final, will be the formation of a few races which occupy those climatic zones to which they are peculiarly adapted and which will form a permanent barrier against successful invasion by their enemies. But, however the process of racial fusion may work out, it is evident that the growing amalgamation of races and peoples and the extension of civilization over the earth will leave no room for the replacement of decadent products of civilization by superior stocks which have not yet been overtaken by culture. If civilization is really an enemy of racial improvement, it will ultimately check the course of man's biological evolution unless some effective means can be instituted for counteracting its insidious effects. That it has a profound effect upon our biological development is a conclusion that cannot be escaped. But to discover just how it acts involves an attack upon a number of problems many of which are of great difficulty and many incapable of solution with the data at present available. Civilization influences human heredity in very diverse ways, some favorable and some the reverse. For a long time it may be impossible to estimate, with any degree of accuracy, the potency of the factors which are responsible for evolutionary changes in man. In an attack upon a complex and many-sided problem such as this, one has to be continually on guard against making hasty generalizations and falling into statistical fallacies. The reader who peruses the following chapters

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will become impressed, if he has not been so before, with the numerous pitfalls into which the student of human evolution is liable to fall. The literature on the subject is full of conclusions based on inadequate evidence, yet put forth with a confidence which in itself should engender a suspicion of their soundness. But the most disappointing feature of the situation is the dearth of facts upon which safe deductions can be based. Demographical statistics have been kept only for a relatively short period of time; and anthropometric data have not been gathered on a scale sufficiently extensive, or over a period sufficiently long, to give us an idea of the trend of development in any considerable group of men. Data compiled at different times and places are often not comparable for want of common standards. If we wish to determine, in what ways the population of any country has been changed we encounter almost insuperable difficulties. The Parliamentary Committee appointed a few years ago to investigate the alleged physical deterioration of the people of Great Britain, after making an exhaustive enquiry, could come to no conclusion as to whether such deterioration had actually occurred. Of course this result is of little value in proving the absence of physical degeneracy in recent times. It is perfectly consistent with the view that such degeneration has even been rapid. It is simply a confession that the data are insufficient for the solution of the problem.

But if we are lacking in records which tell us in what direction human beings have actually been changed, we can at least ascertain something of the action of the forces which are now at work in modifying the inherited qualities of the race. We can observe in a measure how things are actually going on. We can trace the way in which hereditary traits are transmitted; we can study at first hand the action of natural selection in eliminating ill adapted strains of humanity; we can determine the relative degrees of rapidity with which different stocks reproduce themselves, and we can ascertain something of the action of the various selective forces which have arisen as a result of the development of human institutions. Where the data which are being accumulated are

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insufficient for the solution of particular problems the defects may often be remedied by collecting additional information. Many questions of paramount importance are capable of solution by the use of the biometrical methods employed by Pearson and his co-workers of the Galton laboratory. What we need above all is investigation. And it is important that we realize that investigation of the trend of human development is peculiarly timely. Our custom of regarding evolution as an exceedingly slow process in which a few centuries more or less count for relatively little should not make us unmindful of the fact that important racial modifications may at times take place in a very few generations. For an illustration of this fact it is only necessary to allude to the remarkable results which have been achieved, even within a few years, by the selective breeding of plants and animals. Many lines of evidence point to the conclusion that our human inheritance is changing at a comparatively rapid rate. In a species containing the great diversity of hereditary qualities which is exhibited by mankind there are abundant possibilities of rapid transformation. A person with our present knowledge of human heredity and endowed with the authority which the Great Master in Campanella's *City of the Sun* exercised over the matings of men and women, could produce, in a few generations, a remarkable array of diverse types. He could, for instance, breed an albino race, a deaf race, a feeble-minded race, an insane race, a race of dwarfs, a race with hook-like extremities instead of hands, a race of superior intellectual ability, or a race of high artistic talent. It may be said that such changes as may occur in a few generations affect merely the prevalence of characteristics already present, or the making of different combinations of existing hereditary factors. But from the standpoint of human welfare the importance even of such changes is tremendous. They may make all the difference between a breed of wretched degenerates and a race of physical vigor and superior mentality. The human species possessing so great a diversity of hereditary traits and subjected to the influences of so many changing forces both physical and social can scarcely fail to undergo more or less rapid modification. If our

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race would avoid the danger of deterioration and realize the best of its hereditary possibilities we should know first of all what is the present trend of our development and what are some of the more important forces by which our development is guided.

It is to a consideration of the forces which are modifying the inherited qualities of modern civilized peoples that the present book is devoted. The undertaking naturally leads us to discuss the inheritance of those human traits which are of especial significance in relation to the progressive or retrogressive development of mankind. After the first few chapters on this general topic the rest of the book is mainly concerned with a treatment of the selective agencies that determine what types of human inheritance tend to prevail over others, and the relation of these selective agencies to various factors in our social environment.

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CHAPTER II

THE HEREDITARY BASIS

"The experimental study of heredity, development and evolution in forms of life below man must certainly increase our knowledge of and our control over these processes in the human race. If human heredity, development and evolution may be controlled to even a slight extent we may expect that sooner or later the human race will be changed for the better."—E. G. Conklin, *Heredity and Environment in the Development of Men.*

BEFORE entering upon a discussion of the complex biological problem of the evolution of man, it may be useful to touch briefly upon some of the main principles which are observed to hold true for the transmission of hereditary traits. The establishment of the doctrine of evolution naturally lent a great impetus to the study of heredity and the complementary topic of variation. The search for the causes of evolution would be greatly aided by a knowledge of the principles or laws according to which variations in organisms arise and are transmitted to subsequent generations. No one appreciated this fact more than Mr. Darwin as is evinced not only by several chapters in the *Origin of Species*, but especially by his great work on the *Variation of Animals and Plants under Domestication*. It was his conviction that the key to the method of evolution lay in the close and careful study of variation that led to the vast amount of observation and experiment which Darwin devoted to this subject. The ingenious theory of pangenesis by which Darwin attempted to give a provisional explanation not only of inheritance, but of many phenomena of variation as well, shows how thoroughly he appreciated the fundamental importance of true insight into these processes.

Darwin considered his doctrine of pangenesis as a provisional hypothesis, a tentative theoretic formulation of a principle which would introduce some order into what was then a chaos of empiri-

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cally collected facts. He postulated that the different organs of the body gave off into the blood, or other bodily fluids, minute living particles which he called gemmules, and which he supposed to be capable of growth and multiplication. The germ cells were supposed to have a special affinity for these gemmules, their function being to act as storehouses for these bodies. During development the gemmules were sorted out, each kind determining the development of a part of the embryo into the kind of organ from which it was derived.

This theory gave scientific expression to the traditional conception of inheritance according to which the parts of the offspring are derived from corresponding parts of the bodies of their parents. It afforded also a means of explaining how characters acquired by the parents might be transferred to following generations. Darwin, like most of his contemporaries, accepted the doctrine of the transmission of acquired characters which Lamarck had postulated as the chief cause of organic evolution. He supposed that parts which are developed through exercise would produce more gemmules and that this would cause the corresponding part to be better developed in following generations. The hereditary effects of disuse were explained in a similar manner. Granting Darwin's doctrine of pangenesis, the explanation of the transmission of acquired characters followed very naturally. But the fundamental difficulty of the doctrine lay in the artificial and improbable nature of its fundamental assumptions. Although ingeniously worked out and applied, the theory gained few followers, and as knowledge of the cellular basis of heredity came to be more minute and thorough, its incongruity with known facts became more and more apparent.

Although the doctrine of pangenesis has now been given up, its influence upon subsequent theories of heredity is unmistakable. De Vries modified it by eliminating the hypothesis of the centripetal flow of pangens, thus greatly simplifying it and avoiding some of its most improbable elements. The pangens were not supposed to be given off by the cells of the body and stored up in

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the germ cells, but the germ cells were held to receive their store of pangens from antecedent germ cells. The denial of the flow of pangens from the body to the germ cells did away with the means by which Darwin accounted for the transmission of acquired or somatogenic characters. De Vries did not hesitate to accept the logical consequence of his hypothesis although he dwelt comparatively little on this feature of his doctrine.

It is in the writings of Professor August Weismann that we find the opposition to Lamarckism taking the form of vigorous and sustained attacks. Weismann in his early essay *On Heredity* set forth a very simple and plausible theory of transmission in his doctrine of the continuity of the germ plasm. This conception had been put forth previously by several writers (Owen, Galton, His, Nussbaum, Jäger, Rauber), but it did not attract much attention until expounded in the lucid and attractive essays of Weismann who made it the basis of a series of brilliant and elaborate speculations on the mechanism of hereditary transmission. Weismann taught that the germ plasm is a substance separate from the soma plasm which forms the organs of the body, and that it is in no way the product of the body, although it is carried and nourished by the body. Germ plasm is handed on relatively unchanged from one generation to the next, part of it being transformed into soma plasm which differentiates in various ways during embryonic development; but another part of it remaining undifferentiated in the germ cells to form the starting point of the next generation. Some germ plasm is, therefore, handed on in a continuous stream through successive generations, the bodies of the parents acting as "trustees of the germ plasm." It is the continuity of the germ plasm that affords the basis for heredity. Parent and offspring resemble each other not because the offspring are, in any sense, the product of the parent's body, but because both parent and offspring arise from a common substance, the germ plasm. Poulton has aptly said that Weismann's theory makes the offspring the younger brothers and sisters of their parents. We might compare successive generations to a series of plants arising from an underground runner or root stalk.

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The plants resemble one another not because one is derived from the other, but because all are derived from a common source.

Such a view of heredity, sharply opposed as it was to the older views that derived the offspring in some way from the various parts of the body of its parents, made the transmission of acquired characters improbable *a priori*. Weismann accordingly subjected the evidence for such transmission to a searching criticism and came to the conclusion that it was entirely inadequate. His attacks upon the Lamarckian theory which appeared in a series of essays, books and lectures nearly up to the period of his death did much to shake the faith of biologists in this at one time widely accepted doctrine.

Weismann was not content simply to explain heredity as due to the continuity of the germ plasm, and to remove obstacles that seemed to lie in the path of that theory. He attempted to elaborate a theory of the composition of the germ plasm which would explain development, regeneration and various other phenomena in addition to heredity. Investigations into the structure of the cell and especially the peculiar behavior of the sex cells in maturation and fertilization had revealed a wonderful and orderly series of phenomena of which even the contemporaries of Darwin had little dreamed. Weismann was among the first to interpret the significance of these striking phenomena for the theory of heredity and evolution, and the essential part of his early theory of the significance of maturation has received a remarkable verification by recent work. More than any one else Weismann is responsible for directing attention to the importance of the combination of the study of heredity with cytology which has lately been productive of such brilliant results. Many of the features of his elaborate speculative system have been rendered improbable (though we may not say definitely disproved) by experimental work; others have proven to be remarkably prophetic; on the whole, the body of doctrine which may be designated as Weismannism, as it was by Romanes, has afforded a great stimulus to the study and interpretation of the facts of heredity, and has left its very

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evident impress on much of recent thinking on the doctrine of evolution.

The discovery which has meant most for the progress of genetics is unquestionably Mendel's law. The product of years of research in the garden of the monastery at Brünn, Austria, the principles enunciated by Mendel, owing to the fact that they were published in a little-known journal, *The Proceedings of the Natural History Society* at Brünn, failed to attract the attention of the scientific world until they were made known independently by three investigators, Tschermak, Correns and De Vries in the year 1900. Thus began, with the beginning of the 20th century, a new era in the study of genetics. Progress in this field since 1900 has taken place at a very rapid rate. The amount of literature devoted to the subject suddenly swelled to several times its previous volume, and it is probably no exaggeration to say that since the rediscovery of Mendel's law a greater advance has been made toward a scientific analysis of the phenomena of heredity than had been made during all preceding time.

Mendel's law embraces two principles designated commonly as (1) the law of dominance, and (2) the law of segregation. According to the first, when two related but contrasted characters are brought together in a cross the one appears to the exclusion of the other. Mendel found, for instance, that when he crossed tall and dwarf peas the immediate progeny were all tall instead of intermediate in height. When he crossed green and yellow peas the first generation (called the first filial or F_1 generation) consisted entirely of yellow peas. The characters tall and yellow are designated dominant in contrast to dwarf and green which are called recessive.

The recessive characters are not lost, as is shown when the members of the F_1 generation are either interbred or self-pollinated. They appear in the second or F_2 generation along with a certain proportion of dominants. Numerous experiments have shown that in typical cases the dominant and recessive characters are segregated in the second generation in the proportion of three dominant to one recessive. The separation of the original char-

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acters according to definite numerical ratios in the second generation is the principle of segregation which is the most general and significant feature of Mendel's great doctrine.

The recessives which come out in the F_2 generation are pure and hence breed true, but the members of the F_2 generation which show the dominant character are not all alike, as is shown by subsequent breeding. One-third of them continue to produce nothing but dominants during the subsequent generations; but two-thirds of them continue to produce recessives in the ratio of one of the latter to three that show the dominant character. We might write the general formula for the F_2 generation, instead of 3D+1R, as 1DD+2DR+1RR, or one pure dominant, two heterozygous or impure forms and one pure recessive.

Complete dominance is by no means a general phenomenon. Contrasted characters frequently blend in the first filial generation and many gradations occur between complete dominance and a strictly intermediate condition. But this in no wise alters the fact of segregation although it may render segregation more difficult to establish.

A typical instance is afforded by crossing red and white four o'clocks. The F_1 generation consists of flowers of an intermediate or pink color. The second generation, however, consists of one-fourth pure red, one-half pink and one-fourth white. The red and white produce nothing but red and white respectively; they are hence pure or homozygous for these characters. The pink four o'clocks produce red, pink, and white in the 1 : 2 : 1 ratio.

In Mendelian inheritance pairs of characters such as green and yellow, tall and dwarf, etc., commonly appear to segregate independently, giving us all possible combinations of different pairs. Crossing a tall yellow with a dwarf green pea gives us in the F_1 only tall yellow peas, but in the F_2 we obtain 9ty+3tg+3dw +1gw. This is the expected ratio if the members of the two pairs of characters were distributed and combined in independence of each other. As Mendel himself pointed out, characters are distributed in inheritance as they would be if the germ cells were pure as regards one or the other member of a pair of con-

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trasted characters. What is now known of the germ cells enables us to point with great probability to the cellular mechanism by which this purity of the gametes or mature germ cells is maintained. The same mechanism also affords an explanation of the phenomenon of linkage or the tendency of diverse characters to maintain a certain association in inheritance. The mechanism consists of the chromosomes of the nucleus which there are strong reasons for believing maintain their individuality, as they do their number, not only through numerous cell generations in the life of the individual, but through an indefinite number of life cycles of individual organisms. The behavior of these chromosomes in maturation and the process of synapsis immediately preceding maturation is precisely such as would explain the distribution of characters according to Mendel's law if we grant that individual chromosomes contain factors for the production of particular characters. We cannot give an idea of the remarkable success that has been attained in connecting the phenomena of inheritance with peculiarities of chromosome behavior, and must refer the reader to special works and papers dealing with this topic. I can scarcely do more than indicate in a short chapter the various applications of Mendel's law in interpreting many enigmatical phenomena of inheritance. The phenomena of reversion, the results of inbreeding, the heredity of sex and the peculiar phenomena of sex-linked inheritance are seen in a new light since the discovery of Mendel's law.

Since Mendel's law has been found so widely applicable in plants and animals, we should expect to find it expressed also in the inheritance of man. Already numerous human traits are known which give strong evidence of being transmitted in accordance with this law. Since it is not feasible to treat human beings as we do plants and animals it is difficult to ascertain in many cases whether inheritance is in fact strictly Mendelian. A list, though incomplete, of traits which are probably transmitted according to Mendel's law is given in the following table:

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Table of Human Hereditary traits

Dominant Characters	*Recessive or Partly Recessive Characters*
Dark hair	Light hair
Lack of hair (hypotrichosis), Beaded hair	Normal
Dark skin	Light skin
Pigmented skin	Albinism
Partial albinism, keratosis, ichthyosis, tylosis, epidermolysis	Normal skin
Dark eyes	Light eyes
Cataract, pigmentary retinitis, coloboma? glaucoma, displaced lens, nystagmus	Normal eyes
Tall stature (in part)	Short statute (in part)
Achondroplastic dwarfism	Normal
Polydactylism, brachydactylism, syndactylism, Fragility of bone, Symphalangy, exostoses	Normal
Normal	Deaf mutism, otosclerosis
Hapsburg lip, Hare lip (imperfect dominant?)	Normal
Diabetes	Normal
Superior mentality	Inferior mentality
Normal mentality or nervous condition	Feeble-mindedness, epilepsy, insanity, Meniere's disease, chorea, multiple sclerosis
Huntington's chorea, muscular atrophy	Normal

Sex Linked (mostly recessive) Characters

Color blindness, night blindness, hæmophilia, neuritis optica, Cower's muscular atrophy

Certain characters, such as skin color in negro-white crosses, appear to form permanent blends, but as Davenport has attempted to show, this may be a complex case of Mendelian transmission in which a considerable number of determiners for skin color are involved. The great variability in the skin color of mulattoes has been appealed to in support of this view. Cases of complex Mendelian transmission are especially difficult to analyze in man and we may have to judge them in the light of analogy with what occurs in the lower animals. With the progress of genetics more and more success is being attained in the resolution of complex and apparently irreconcilable cases in terms of Mendelian principles. As we learn more of inheritance in man, the more we find that it falls into line with what is known of inheritance in the

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lower forms of life. It is fortunate for the solution of many of our problems that we are so closely affiliated with the brute creation. This is especially the case in regard to the problems involving a knowledge of human heredity, for we may learn more of this subject by studying heredity in other forms than by studying the heredity of man himself. Unfortunately, however, for many problems of the highest importance we cannot directly avail ourselves of our knowledge of the heredity of lower forms. Many of the qualities that make human beings socially desirable or the reverse do not have their strict counterparts in the animal world, and often they represent complex states influenced greatly in their expression by environmental agencies and hence presenting almost insuperable difficulties in the way of resolution into their component hereditary factors. In the following three chapters we shall deal with the transmission of some of the traits which are of greatest importance in regard to the progress of the race.

We cannot close this preliminary chapter on inheritance without some discussion of the relative importance of heredity and environment in the development of man, especially since the question is one upon which there exists an extraordinary amount of confusion of thought. The question, Which is the more important, heredity or environment? has provoked endless discussion. To argue over the question in its general and unqualified form is futile, since both heredity and environment are absolutely essential to every organism. The difficulty is much like asking which is the more important for the maintenance of life, matter or energy? Heredity under the same environment makes the difference between a cow, bird, insect or plant. Environment may make all the difference between a normal organism and a monstrosity or between a living organism and no organism at all. Every organism is a function of both hereditary and environmental factors. We may express this in the formula $O=f(HE)$. Alter either H (heredity) or E (environment) and the O is changed. Without either H or E the organism would not exist. We cannot say that in general one is more important than the other because each is all important.

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But while it is futile to argue over this question in the abstract, it may become a very practical problem if it is narrowed down to particular characteristics of a given breed under a specified range of conditions. We may illustrate this by considering the effects of heredity and environment in raising corn. Everyone knows that corn grown on rich fertile soil produces a much greater yield than corn grown on poor soil. Everyone knows also that, in a given soil, the yield depends largely on the variety of corn that is used for seed. There are varieties which in fair soil will yield over 100 bushels per acre; others under the same condition which produce only miserable nubbins yielding less than five bushels per acre; and some, to take an extreme case, which would produce no seed at all. We get a variation due to heredity between say 150 bushels per acre and 0. If we take extreme environmental conditions we get a variation in a given strain between the maximum yield (say 200 bushels per acre) and 0, for it is obvious that if we planted our corn in an environment sufficiently unfavorable it would not grow at all. There is no use arguing which is the more important in raising corn, good seed or good soil and climate. If, however, we ask whether it is more important to make the best choice of seed between variety A and variety B or to make the best choice of one or the other of two pieces of ground, our question is a sensible one and capable of fairly easy solution. We may test our varieties under given conditions and compare our yield. We could then obtain a measure of their hereditary difference under a given constant environment, and express it in a ratio such as A:B: :3:4. Similarly we might test out the yield of each variety in our two fields and we might find that one field C is so much better than the other that both varieties produce twice as much in the first as they did in the second. If they continue to do so over a period of years varying with temperature, rainfall, etc., we might say that for these particular varieties of corn the relative influence of fields C and D is as 2:1. Therefore we might conclude that the choice of a proper field is more important than the choice of the best seed. If, however, it was a question of the seed of variety B and the seed of variety C

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the case might be different. The latter variety might not yield more than a fourth of the former in either of the fields. In this instance the choice of the best seed would be more important than the choice of the best field.

When we compare the influence of heredity and environment it is necessary to state what particular hereditary conditions we are comparing with what given range of environmental conditions. We then have a soluble problem, at least theoretically. We might make a rough estimate of the relative importance of the hereditary conditions that are commonly found within the limits of the species or variety with the conditions that are produced by the variations of environment to which the species is commonly exposed. Leaving out of account the variations in heredity that *might* occur and taking the average of such variations as are actually met with, and leaving out of account what environmental conditions *might* accomplish and considering in general only what is actually done, we may obtain results that can be compared. We might find our species to be remarkably uniform in its hereditary constitution, and that the bulk of the diversity within it could be attributed to the effect of external conditions. On the other hand, the species might possess much hereditary variability like the mixed breeds of many of our domestic plants and animals in which the differences of innate constitution are much more conspicuous than those produced by the environment.

Homo sapiens, the species in which we are particularly interested in the present connection, contains a high degree of hereditary diversity. Not only does each of the major divisions of the species (if we may be permitted to group all mankind into one species) contain numerous minor groups which are commonly further subdivided, but most peoples, especially among civilized nations, represent racial mixtures of many different stocks. A little observation of the multitudes we encounter in going along a street cannot fail to impress one with the heterogeneity of his fellow creatures, and it does not require extensive dealings with our kind to convince one that they are as diverse in mental

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aptitudes, disposition and character as they are in their form and features.

The extent to which our human differences are hereditary is a matter about which there is much difference of opinion. Concerning the peculiarities of features and complexion which are characteristic of racial subdivisions and which may be seen very frequently to run in members of a family there is little opportunity for disagreement. Stature, strength, endurance, eyesight and temperament, since they are obviously influenced by the environment are frequently considered as affected more by the environment than through variations in hereditary constitution. We cannot test the matter experimentally as we might in dealing with characters of corn or wheat, but it is possible to investigate the subject by statistical methods. Professor Karl Pearson and several of his associates of the Galton Laboratory of the University of London have tested the relative influence of heredity and environment in a number of human traits such as eyesight, height, weight and intelligence. Their method is to ascertain the degree of similarity existing between certain characteristics occurring in parent and offspring and among the siblings of the same family. These similarities may be expressed numerically by a coefficient of correlation. Coefficients of correlation were worked out also for various environmental differences. These correlations if based on a sufficient number of cases will afford a measure of the influence exerted by the environment. Then the correlations between relatives may be compared with those correlations which are the result of environmental influence. In the study of the relative influence of heredity and environment on defects of vision Barrington and Pearson ascertained that the coefficient of correlation between parent and offspring and between siblings for keenness of vision was from .4 to .6 which is much the same value as that which is found for other hereditary traits. They measured the correlations of keenness of vision and refraction with environmental conditions in a large number of school children living under a variety of circumstances, and found that these correlations were very small. In other words, the eyesight of children

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showed very little effect of the different environments to which the children were exposed. Presumably, therefore, differences in vision met with among children are the results of differences of inheritance much more than differences of environment. Whether differences among human beings are due in greater measure to heredity depends very largely on the characters studied. Differences in eye color are due almost entirely to heredity, as the character shows scarcely any effect of *ordinary* environmental changes. In stature and weight environmental influence is more obvious although heredity is an important factor. In manners and customs environmental influence is more obvious still, and whether a person talks English or Chinese may depend entirely upon the locality in which he is raised. If he had the heredity of a horse or a cow he would be unable to talk either, but if his heredity were such that he could talk any human language, environment would determine what language he would speak or whether or not he would speak any.

A good illustration of the relative influence of heredity and environment is afforded by the resemblance of so-called identical twins compared with that of twins of the usual kind. The recognition of these two classes of twins is due to Francis Galton, who gave several illustrations of striking similarities between twins which he termed identical. Ordinary twins are about as different as other members of the same family. They frequently exhibit marked differences in physical traits, in intelligence and disposition, and the almost identical surroundings in which they are frequently brought up, fail to overcome their inherited differences which are often conspicuous even in early life. One of Galton's correspondents describes his twin offspring by saying "They have had exactly the same nurture from their birth up to the present time; they are both perfectly healthy and strong, yet they are otherwise as dissimilar as two boys could be, physically, mentally and in their emotional nature." Another correspondent says of a pair of twins, "They were never alike either in body or mind, and their dissimilarity increases daily. The external influences have been identical; they have never been separated."

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While ordinary twins show varying degrees of resemblence, identical twins belong apparently in a class by themselves. It is a commonly accepted view, having much evidence in its favor that true identical twins which are always of the same sex, are developed within the same chorion and arise from the same fertilized egg. They may therefore be regarded as having the same heredity. Among armadillos, *Dasypus novem-cinctus*, it is known that commonly four young are derived from a single ovum, which develops beyond the gastrula stage before giving rise to four embryos, and it is not improbable that a similar procedure is occasionally followed in the development of twins in man. Double monsters in man are of the same sex and are known in many cases to have been enclosed in the same chorion, but it is unfortunate that direct observational evidence that identical twins are in fact monochorial is lacking although many facts support this conclusion. The cases of remarkably close resemblance between twins are so numerous that it is not reasonable to suppose that they are the results of merely chance associations of similar ancestral characteristics. Galton remarks that, "Among my thirty-five detailed cases of close similarity, there are no less than seven in which both twins suffered from some special ailment or had some exceptional peculiarity. One twin writes that she and her sister 'have both the defect of not being able to come down stairs quickly, which, however, was not born with them, but came on at the age of twenty.' Three pairs of twins have peculiarities in their fingers; in one case it consists in a slight congenital flexure of one of the joints of the little finger; it was inherited from a grandmother, but neither parents, nor brothers, nor sisters show the least trace of it. In another case the twins have a peculiar way of bending the fingers, and there was a faint tendency to the same peculiarity in the mother, but in her alone of all the family. In a third case, about which I made a few enquiries, which is given by Mr. Darwin, but is not included in my returns, there was no known family tendency to the peculiarity which was observed in the twins of having a crooked little finger. In another pair of twins, one was born ruptured and the other became so at six

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months old. Two twins at the age of twenty-three were attacked by toothache, and the same tooth had to be extracted in each case. There are curious and close correspondences mentioned in the falling off of the hair. Two cases are mentioned of death from the same disease; one of which is very affecting. The outline of the story was that the twins were closely alike and singularly attached; . . . they both obtained Government clerkships and kept house together, when one sickened and died of Bright's disease, and the other also sickened of the same disease and died seven months later." The other cases of striking resemblance given by Galton and the additional data afforded by later investigators clearly indicate the existence of a class of twins characterized either by identical inheritance, or an inheritance so similar as to be unaccountable according to the ordinary laws of hereditary transmission. This very close resemblance in bodily and mental states commonly persists when the twins have been long separated and exposed to different environments.[1]

The ordinary differences of environment met with in the life of people of much the same mental status apparently fail to produce changes in the personality of human beings as great as commonly met with in the children of the same parents. Whatever may be said of the differences which either heredity or environment might produce, there are strong grounds for the statement of Galton's "that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly to be found among persons of the same rank of society and in the same country. My fear is, that my evidence may seem to prove too much, and be discredited on that account, as it appears contrary to all experience that nurture should go for so little. But experience is often fallacious in ascribing great effects to trifling circumstances. Many a person has amused himself with throwing bits of stick into a tiny brook and watching their progress; how they are arrested, first by one chance obstacle, then by another; and again, how their onward course is facilitated by a combina-

[1] Additional information on the subject may be found in number 9 of the *Journal of Heredity* (Dec., 1909), which is devoted entirely to twins.

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tion of circumstances. He might ascribe much importance to each of these events, and think how largely the destiny of the stick had been governed by a series of trifling accidents. Nevertheless all the sticks succeed in passing down the current, and in the long-run, they travel at nearly the same rate. So it is with life, in respect to the several accidents which seem to have had a great effect upon our careers. The one element, that varies in different individuals, but is constant in each of them, is the natural tendency; it corresponds to the current in the stream, and inevitably asserts itself."

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CHAPTER III

THE INHERITANCE OF MENTAL DEFECTS AND DISEASE

"Our human civilized stock is far more weakly through congenital imperfection than that of any other species of animals, whether wild or domestic."—Francis Galton, *Inquiries into Human Faculty.*

THAT many forms of mental deficiency and disorder are capable of hereditary transmission, has long been recognized, but it is only recently that attempts have been made to discover the precise rules according to which such transmission takes place. Much, however, still remains obscure in regard to this important topic. The vast literature on the subject contained in works on medicine and pathology, in numerous medical journals and various other publications consists mainly in the discussion of isolated cases of transmission, or the compilation of mass statistics from the records of institutions for the care of the mentally abnormal. Institutional records being often gathered in a more or less perfunctory manner, and by many different persons, are apt to include numerous inaccuracies and are pretty sure to fall short of the desired degree of fullness. The relatives of mental defectives from motives of family pride frequently conceal the existence of defects in other members of the family, and even when they honestly attempt to give all the information they possess they often fail to furnish data of any value.

It is not surprising, therefore, to encounter wide differences of opinion among authorities concerning the extent to which various forms of defect depend upon a hereditary diathesis. Practically everyone whose opinion is of any value concedes to heredity a certain rôle in the causation of neuropathic traits. A part of the difference of opinion doubtless depends upon the circumstance that the relative potency of hereditary and environmental factors

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is often difficult to estimate; but it requires no great discernment to perceive that many rather confident expressions of opinion are based on lack of familiarity with the principles of hereditary transmission, or a very inadequate acquaintance with the investigations that have been made in this field.

The method of investigation employed by the Eugenics Record Office at Cold Spring Harbor, Long Island, is one that is in some respects considerably superior to those commonly followed. Instead of collecting mass statistics a more intensive study is made of special cases. For this purpose trained field workers are employed who make the acquaintance of the relatives of the patients investigated, get into friendly relations with them, and through personal impressions and a knowledge of their history are enabled to form a tolerably accurate judgment of their mental status. The full and careful study of several pedigrees of mental defectives promises to throw more light on the precise method in which mental defects are inherited than any amount of unanalyzed data collected from the loose records of institutions. Field workers need to be psychologists skilled in the methods of measuring intelligence and of detecting mental aberrations, and endowed with the attributes of tact, patience and an ingratiating personality. Data secured by field workers have already been proven of considerable value in throwing light on the probable mode of transmission of mental defect, although there is room for considerable refinement of method and thoroughness of enquiry in much of the investigation which has thus far been carried on. The intensive study of pedigrees has been the chief method of those whose aim it has been to show that mental defect is transmitted according to Mendel's law. Whatever may be the issue of the controversy over whether or not mental defects behave as mendelizing unit characters, insight into the question can only come by the thorough, critical and unbiased study of particular pedigrees.

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INHERITANCE OF FEEBLE-MINDEDNESS

Feeble-mindedness may occur in various degrees from the lowest grades of idiocy to the condition occurring in those who are classed as "dull normal." In most of the feeble-minded there is a general lack of mental power, but exceptional cases occur in which highly developed special talents go along with marked deficiency in other respects. Blind Tom who possessed a phenomenal aptitude for playing any piece of music he may have heard was practically an imbecile. Often these "idiots savants" possess remarkable memory, as in the case of the boy described by Langdon Down, who could repeat verbatim pages from a book that he had once read. Some of the mathematical prodigies are otherwise mentally defective. Heron reports a boy, nearly an idiot, who when given a man's age could calculate quickly the number of minutes he had lived. Another boy could multiply any three figures with any three others almost as rapidly as they were written, although he was of a very low grade of mentality.

From a eugenic standpoint the very lowest types of mental defectives, such as idiots, do not present a very difficult problem as they cannot care for themselves and are, therefore, usually kept as institutional charges where they cannot propagate their kind. Similarly the low grades of the feeble-minded are quite easily dealt with, so that there is a tendency for the very lowest types of mentality to disappear of themselves. The death rate of the lower grades of defectives is relatively high. Barr states that out of 625 mental defectives the largest number of deaths occurred between the tenth and twentieth years; "comparatively few passed the twenty-fifth year." Tuberculosis, epilepsy, pneumonia and diseases of the digestive system were the most frequent causes of death. Institutional life may have increased this death rate, as it only too often has done in homes for orphan children, but the lower grades of mental defect belong to poor physical stock which has a natural tendency to become extinct. It is the higher grades of feeble-mindedness which are eugenically and socially the greatest menace. Apparently normal and even

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superficially bright, many of the moron class pass for people of average intelligence; or at least they do not attract general attention on account of their inferior intellect. This class constitutes a considerable proportion of human beings who being unable to support themselves are apt to become a public burden. It furnishes the criminal class with a considerable proportion of its recruits, and it supplies a large number of prostitutes, a class which recent studies have shown to contain a high percentage of mentally inferior women.

The feeble-minded tend to marry their own kind, or to produce children without the ceremony of marriage. In cities they tend to drift into association with vicious and criminal elements of the community and are often led into vice and crime more through inherent weakness of intellect and will than natural depravity of their own. In the country they frequently segregate into communities, where there is often intermarriage of related stocks which brings forth the latent defects of both sides. Such rural communities are characterized by poverty, alcoholism, sexual immorality and crime. The histories of several notorious feeble-minded families have been followed in recent years and they have yielded results of much interest and importance to students of social problems. One of the most noteworthy of these instances forms the subject-matter of Goddard's fascinating book, *The Kallikak Family*. The starting point of the investigation described in this book was made in the effort to trace the ancestry of a feeble-minded girl, Deborah, who had become an inmate of a home for the feeble-minded at Vineland, N. J. Deborah had been born in the almshouse. Her mother was feeble-minded and had had several other children by various men. The field worker, Miss E. S. Kite, who worked out the genealogy of the Kallikak family, succeeded in tracing its ancestry to a Martin Kallikak, a soldier in the revolutionary war. While at an inn Martin Kallikak made the acquaintance of a feeble-minded girl by whom he had a son named Martin Kallikak, Jr. Later Martin Kallikak married a normal woman of good family and raised several children. "All of the legitimate children of Martin, Sr., married into

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the best families in their state, the descendants of colonial governors, signers of the Declaration of Independence, soldiers and even the founders of a great university. Indeed, in this family and its collateral branches, we find nothing but good representative citizenship. There are doctors, lawyers, judges, educators, traders, landholders, in short, respectable citizens, men and women prominent in every phase of social life. They have scattered over the United States and are prominent in their communities wherever they have gone. Half a dozen towns in New Jersey are named from the families into which Martin's descendants have married. There have been no feeble-minded among them; no illegitimate children; no immoral women; only one man was sexually loose."

In sharp contrast to this branch of the family stand the descendants of the feeble-minded girl. Of these 480 have been traced. "One hundred and forty-three of these," says Goddard, "we have conclusive proof were or are feeble-minded, while only forty-six have been found normal. The rest are unknown or doubtful. Of these descendants there have been 36 illegitimate, 33 sexually immoral, mostly prostitutes, 24 confirmed alcoholics, 3 epileptics, 82 died in infancy, 3 criminals, 8 kept houses of ill fame. The Kallikaks married into other families, usually of their own type, producing 1,146 individuals. "Of this large group," says Goddard, "we have discovered that two hundred and sixty-two were feeble-minded, while one hundred and ninety-seven are considered normal, the remaining five hundred and eighty-one being still undetermined."

The history of this family is a long tale of feeble-mindedness, alcoholism, poverty and prostitution. Children were numerous, but although infant mortality was high, the family increased rapidly in successive generations. Wherever the Kallikaks wandered, whether in the backwoods or in the slums of cities they retained the same characteristics.

There are several Kallikak families, several of which, such as the Nams, Pineys, Hill Folk, Tribe of Ishmael, Zeroes, etc., show little but a monotonous repetition of the same history

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of pauperism, alcoholism, harlotry and frequently graver forms of crime.

Several investigators have drawn the conclusion that feeble-mindedness, which is an inherited trait in probably four-fifths of the cases, is transmitted as a recessive or partially recessive character, although it is not so evident that it behaves as a single unit in inheritance. Feeble-minded children sometimes come from normal parents, both of whom, however, may have been heterozygous for feeble-mindedness. Such children frequently result from the mating of a feeble-minded person with a normal individual, but when both parents are feeble-minded we find that in nearly all cases all the children are feeble-minded, as we should expect. The few recorded exceptions to this rule may be due to illegitimacy which is a not infrequent occurrence among this class, or to mistaken judgment of the parents' or the child's mental condition, or the fact that one parent may have been feeble-minded through accident or disease. Out of 41 matings in the Kallikak family in which both parents were feeble-minded there were 222 feeble-minded children and only two others that were considered normal. In his work on *Feeble-mindedness* Goddard states that of 482 children both of whose parents were feeble-minded all but six were reported to be feeble-minded also.

The conclusion of Goddard that only mentally defective children are to be expected from two mentally defective parents which was announced by Davenport in 1911 as "the first law of inheritance of mental ability" was materially modified in a paper on the *Hill Folk* published by Danielson and Davenport in 1912. "The analysis of the data," according to the authors, "gives statistical support to the conclusion abundantly justified from numerous other considerations, that feeble-mindedness is no elementary trait, but is a legal or sociological, rather than a biological term. Feeble-mindedness is due to the absence, now of one set of traits, now of quite a different set. Only when both parents lack one or more of the same traits do the children all lack the traits. So, if the traits lacking in both parenrs are socially important the children all lack socially important traits, *i. e.*, are feeble-

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minded. If, on the other hand, the two parents lack different socially significant traits, so that each parent brings into the combination the traits that the other lacks, all of the children may be without serious lack and all pass for 'normal.'"

This change of front is due to the discovery of several cases in which it was alleged that normal individuals were produced by parents both of whom were mentally defective. In fact the percentage of such cases was rather high. Considering both low grade and high grade feeble-mindedness together it was found that the percentage of defectives resulting from nulliplex matings (feeble-minded × feeble-minded) was only 77.3 per cent instead of 100 per cent. Matings of normal N N with feeble-minded n n give 37.5 per cent of defectives instead of none which would be expected even on Danielson and Davenport's own hypothesis. No explanation, however, of the latter discrepancy is offered.

Chances for error in the investigation of the mentality of such communities as the *Hill Folk* are numerous as the authors seem to realize. "The problem that a field worker meets is to analyze each person in the pedigree in respect to his mental and moral traits from a complete acquaintance and from a comparison of the description of others. After all the evidence from personal visits, interviews with relatives, physicians, town officials, and reliable neighbors, and facts from court and town records have been collected, it is, even then, difficult to represent these characteristics exactly by the standard symbols which are used for the biological study of inherited traits. The distinction between an ignorant person who has normal mental ability and a high-grade feeble-minded one who has not, is often as impossible to make as that between medium and low grade feeble-mindedness."

A careful examination of the *Hill Folk* will show that it exhibits little internal evidence of critical judgment, which is so necessary in dealing with the inheritance of mental defect. We find in examining the alleged matings of feeble-minded with feeble-minded that in one case all that is said of the mental state of one consort is that he was "a wild immoral fellow"; of another, that he was "a plodding dull drinking fellow"; of another, that he

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belonged to an "unintelligent family"; of another, that he was "a good workman, but very alcoholic," besides being "round-shouldered, narrow-chested, and in poor physical condition"; of another, that he was "a wild fellow," who broke into a house with intent to rape; of another, that he was "a shiftless drinking fellow"; who later got into trouble for assaulting an officer; of another, that she was "shiftless and neurotic" and married a "shiftless and alcoholic man." When such persons are put down as feeble-minded our confidence in the proper classification of the matings becomes rudely shaken. The authors seem to consider shiftlessness as almost tantamount to feeble-mindedness, and if this is combined with alcoholism or sexual irregularity the judgment of the mental condition of the offender is apt to be particularly harsh. Estimates made after a "brief acquaintance," or from "descriptions of others," etc., when we are attempting to gauge the innate ability of people of little education, raised in a very unfavorable environment, and often with a constitution impaired by the use of alcohol, are very apt to be biased. One cannot take seriously conclusions based on evidence of this sort. It is of course not improbable *a priori* that feeble-mindedness may rest upon different forms of hereditary defect in different individuals. But that offspring of normal mentality may be produced from two parents who are hereditarily feeble-minded cannot be considered as established, I think, by the data of Danielson and Davenport's memoir.[1]

Notwithstanding the striking results obtained by Goddard the complete dominance of normal mentality over feeble-mindedness cannot be regarded as clearly established. In a very large number of cases in which characters obey the Mendelian rules of segregation the organisms which are heterozygous for the characters in question show a more or less intermediate condition. Frequently, as in the dominance of polydactylism, there is a large degree of variation in the extent to which the dominant character is devel-

[1] Dr. Tredgold who has carefully traced many pedigrees of feeble-minded families states that his experience bears out the conclusion "that the mating of two mentally defective individuals yields offspring who are all defective."

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oped. In the F_1 generation of a normal and a polydactylous person the dominant character varies from complete development to entire absence of visible somatic expression. In view of the frequency of such facts as these, and considering also the continuous variability in the manifestation of mental qualities in general, it is inadmissible to draw the conclusion that the mating of a normal person, even of sound stock, with a mental defective will be productive of mentally normal offspring. The supposition that matings of this sort are productive of offspring whose mental characters tend to be more or less intermediate between those of their parents, is one that is quite in accord with the large body of facts that has accumulated on the inheritance of mental traits. There are cases in which the mating of a person of good intelligence with a person of subnormal mentality has resulted in fairly intelligent offspring, but unions of this kind as a rule are not productive of happy results. Normal progeny from such matings may represent cases where for some reason, the dominance of one parent is unusually complete. But the many cases in which the matings of normal and defective are productive of a variable degree of mental defect in the offspring may be to a considerable degree the result of imperfect and variable dominance.

It has been generally assumed by a number of American workers that where mental defectives arise from such matings the apparently normal person was heterozygous. To account for the large number of defectives thus arising it has to be supposed that people heterozygous for mental defect are very common. In Goddard's charts (*Bull. Eugen. Rec. Off.* No. 1) out of thirty matings of feeble-minded with presumably normal individuals all but two produced some feeble-minded offspring. In one of these (chart 6) three of the offspring, although they were marked normal, had feeble-minded children. In the other family the only recorded mating among the presumably normal children was between an alcoholic woman and a man marked normal from another stock. This mating produced three normal and two feeble-minded children.

It must be borne in mind, however, that the people marked

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normal who mate with the feeble-minded are apt to be people of relatively poor stock. Probably many of them should be classed as high-grade morons, or at least people below the average grade of intellect. A considerable proportion of them carry the germs of other forms of defect and many of them are addicted to alcohol. The individuals designated in the charts as N, with perhaps more of courtesy than they really deserve, are scarcely comparable to the average of the general population. The charts, which are frequently chosen to illustrate striking cases, may give an exaggerated notion of the frequency with which the matings of feeble-minded and normal produce feeble-minded offspring. However, when one goes over the matings in the Kallikak family where all the known matings are recorded, it will be found that feeble-minded offspring result from over two-thirds of the cases of normal × feeble-minded matings. As we have seen, the mating of normal and feeble-minded among the Hill Folk gave 37.5 per cent of defective offspring.

It is evident that we need not assume that our inheritance is vitiated to the extent that these studies seem to indicate if we grant that the dominance of mental normality is imperfect and variable. A tendency toward defectiveness is not only subject to various environmental influences both before and after birth, but it is combined with various other hereditary traits in different offspring which could scarcely fail to influence its expression. In the case of the insane diathesis we should expect that such influences would have a profound effect on the manifestation of insanity, and in feeble-mindedness they might well produce differences which would determine whether or not a person were classed as feeble-minded or as normal.

Both Heron and Pearson have contended with much reason that mental defect varies continuously. There are all grades from the lowest forms of idiots to high-grade morons, and there is no line which can be drawn between the latter and people of normal intelligence. Mental defectiveness is a matter of degree, varying like height, weight, physical strength, hair color and a number of other human qualities, in a manner that permits of no grouping

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into clearly defined classes. This fact does not necessarily indicate, as Pearson and Heron imply, that the various kinds of mental defect are not transmitted according to Mendel's law. It is not uncommon for segregation to occur in the usual Mendelian manner, although the character segregated may fluctuate so as to form a perfectly continuous series. Where the germinal factors manifest themselves somatically in characters that undergo a large amount of fluctuating variability, it naturally makes the demonstration of Mendelian segregation more difficult. Where, as in human beings, it is not feasible to employ experimental methods of analysis the difficulty of establishing Mendelian inheritance beyond cavil is greatly enhanced. One has to be guided by probabilities. The best that can be done is to select tentatively that hypothesis which gives the most plausible interpretation of the phenomena to be explained and is best in accord with what is known of the principles of inheritance followed in other fields. The very general occurrence of Mendelian inheritance among plants and animals of both primitive and highly organized types, and the remarkable success attained in explaining apparently non-conformable phenomena in terms of Mendel's law, creates a very justifiable presumption in favor of the conclusion that mental defects are transmitted according to the same laws that prevail so widely in the plant and animal world. That inheritance in man obeys the laws followed by organisms in general is also indicated by the undoubted appearance of types of Mendelian inheritance among human characteristics.

But while the general occurrence of Mendelian inheritance in the organic world creates a presumption in favor of the conclusion that mental traits in man are transmitted according to the same rule, it must be conceded that there are certain characters whose mode of transmission seems to present a clear exception to this type of inheritance. It is true that such cases are comparatively rare. But there is a much larger number of cases which *may* follow Mendel's law, but in which it has never been proven that they actually do follow it. The successful extension of Mendelian analysis may justify us in shifting the burden of proof from the

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shoulders of the Mendelian to those of his opponent. But if it is granted that a characteristic is transmitted according to Mendel's law it remains to be determined whether it presents a simple typical illustration of such transmission or follows a more complex type of Mendelian inheritance. Where several factors are involved, inheritance, though Mendelian, may present the appearance of the old-fashioned blending type, and should be dealt with in practice as though it were truly blending.

Let us suppose for instance that feeble-mindedness depends not upon the loss of a single factor in the germ plasm, as commonly assumed, but upon the presence of many such factors belonging to different allelomorphic pairs. The matings of two feeble-minded persons, thus bringing together two germ plasms generally tainted with defectiveness, would be expected to produce nothing but feeble-minded offspring. The matings of a normal with a feeble-minded person migh tbe expected to produce variable results. Various factors affecting mentality in the normal individual would doubtless tend to give rise to various degress of mental development. There would doubtless be also a considerable variation in the gametes contributed by the feeble-minded person. Some of the combinations of germ cells might be expected to produce a much better mental inheritance than others. Add to the congenital differences thus arising, other changes due to intra-uterine influence, circumstances affecting early childhood, and various other environmental factors, and we would get a varied group whose individual members would be classed as feeble-minded or normal, in proportions varying according to the standard of the person making the classification and the correctness of his judgment of the persons passed upon. Naturally the categories found could be interpreted as resulting either from the mating DR×RR or, in case all the offspring were considered normal, from DD×RR, the normal parent being designated after the usual fashion as DD or DR according to whatever assumption is necessary to bring the facts into accord with the theory. It is practically impossible to determine that a person is a DR unless one of his immediate parents is an RR. The presence of RR's in

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near relatives may establish a certain presumption in favor of his being heterozygous, but it does not prove it.

Most of the facts of the inheritance of mental defect are conformable to the hypothesis that such defect is dependent upon a number of factors instead of a single one. If the factors for heritable qualities are borne by chromosomes, as there is now such strong evidence for believing, is not every chromosome, or even every part of a chromosome the bearer of factors that influence mentality? Is it conceivable that there is a unit factor for mind located somewhere in a chromosome? There may be specialized parts of the chromosome complex whose influence on the development of the body is such that if they are modified they produce a heritable mental defect. It is of course possible that a change even in a small part of a chromosome would produce the defect in question. It is also possible that the development of superior ability may require the influence of a special part of an individual chromosome. But, since in the absence of both these chromosome regions we have mentioned, some type of mentality would doubtless be produced if we should get an organism at all, it seems improbable *a priori* that the inheritance of general mental development would follow the simple Mendelian formula for the inheritance of two contrasted characters. In general, it may be probable that the lower types of mentality are recessive to the higher types much as lighter shades of coat color in mammals are usually recessive (or hypostatic) to the darker shades. While a feeble-minded person *may* be one whose infirmity is due to a particular modified factor he, or at least some feeble-minded persons, may owe the defect to more widespread damage to the germ plasm. I very much doubt if the facts concerning the inheritance of defect are as yet known with sufficient precision to warrant our trying to force them into simple Mendelian formulæ. Of course, if two stocks differ by a single factor only, their progeny would be expected to afford an illustration of simple Mendelian inheritance. But since the inheritance of any human family probably differs in very numerous ways from that of any other, and since any change in any part of the germ plasm could scarcely help having a certain

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influence on the mentality of the individual concerned, it is *a priori* very improbable that the inheritance of mental defect is adequately describable in simple Mendelian terms. Most of the charts which group human beings categorically as feeble-minded or normal, as we class mice as gray or albino, take no account of the varied manifestations of mentality which really occur. They are liable to give a false ~~or misleading~~ appearance of simplicity which in fact has no existence.

Whether the inheritance of mental defect follows simple or complex Mendelian formulas, or whether, indeed, it may not take place according to the older conceptions of blending inheritance, makes comparatively little difference in the practical treatment of hereditarily defective persons. The fact that defective mentality is strongly transmitted is established beyond the possibility of sane objection, and the particularly disastrous results that are pretty sure to follow from the mating of two mental defectives have certainly been made sufficiently impressive by the work of recent investigators.

EPILEPSY

Although Morel questioned its hereditary transmission, there is now a general consensus of opinion that epilepsy is often inherited. This dreaded malady occurs in a variety of forms (petit mal, grand mal, Jacksonian epilepsy, etc.) and is frequently associated with other forms of defect such as feeble-mindedness and insanity. Many cases are doubtless to be attributed to trauma, disease and alcohol, although a part of such cases probably have a basis in inheritance as well. Concerning the proportion of cases attributable to heredity I can do no better than to quote from Barr (*Mental Defectives*, p. 212) "Hammond in a study of 171 epileptics, finds heredity a cause in 45,—21 of these proving direct; Echeverria gives 26 per cent of 306 as descendants of epileptic parents. Delasiauve found the same in 33 out of 300 cases, and Herpin 10 in 68 cases. . . . Hamilton states that fully 50 per cent of his 980 cases are attributable to heredity. Gowers

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gives 35 per cent, and the 56 per cent of my table coincides with Spratling's record in 1,100 cases."

The gravity of the disease (it is seldom curable) and its not infrequent connection with some of the worst crimes of violence, render the subject of its mode of transmission of especial importance. The first serious attempt to show that epilepsy is inherited according to Mendel's law was made by Davenport and Weeks who followed up the pedigrees of many of the inmates of the New Jersey State Village for Epileptics at Skillman, N. J. The pedigrees were obtained mainly by field workers and the data were analyzed according to the assumption that the matings fell into the classes which might be expected to occur in simple Mendelian inheritance. We quote the principal conclusions of the investigation: "Epilepsy and feeble-mindedness show a great similarity of behavior in heredity supporting the hypothesis that each is due to the absence of a protoplasmic factor that determines complete nervous development."

"When both parents are either epileptic or feeble-minded all their children are so likewise.

"The conditions named migraine, chorea, paralysis, and extreme nervousness behave as though due to a simplex condition of the protoplasmic factor that conditions complete nervous development. . . .

"When such a tainted individual is mated to a defective about half the offspring are defective.

"When both parents are simplex . . . and 'tainted' about one-quarter (actually 30 per cent) are defective.

"Normal parents that have epileptic offspring usually show gross nervous defect in their close relatives.

"While we recognize that 'epilepsy' is a complex, yet there is a classical type numerically so preponderant that, in the mass, 'epilepsy' acts like a unit defect."

Only one instance is given in which both parents were epileptic and it happened that both were feeble-minded also. Of their four children one was feeble-minded and died before 14; but the other 3 all developed epilepsy. In a subsequent paper by Weeks two

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additional cases are given. In one of these there were 12 children who survived infancy (there being 4 stillborn). Of these three were epileptic, one was feeble-minded, two were migranous and six were neurotic. In the other case of the four surviving children (4 being stillborn) two were epileptic, one was feeble-minded and one "unclassified." In the two latter families nothing is recorded of the ages of the children except that they were over 14, although one would expect some explanation of the apparent discrepancy between the results and the theoretical expectations. If offspring from two epileptic parents may be simply migranous or neurotic the "character" that is transmitted must be subject to a remarkable degree of fluctuation.

As the authors remark, feeble-mindedness and epilepsy appear to be closely related in their transmission. Nine matings in which both parents were feeble-minded gave one or more epileptics in each family, while a larger number of children were simply feeble-minded. In Week's data which includes all the cases in the paper by Davenport and Weeks there is given 15 matings in which one parent is epileptic and the other feeble-minded. Of the 55 offspring who lived to be old enough to classify, 28 were epileptic, 26 feeble-minded, and 1 insane. Of the 27 matings in which both parents were either feeble-minded or epileptic all of the offspring above 14 about whose condition anything could be ascertained were classed as mentally abnormal, 43 being epileptic, 58 feeble-minded, one insane, 2 migranous, and 8 neurotic,—certainly a fearful harvest of undesirable progeny.

Notwithstanding the hereditary association of epilepsy and feeble-mindedness, it cannot be maintained that these are hereditarily equivalent neuroses. Epilepsy is much more likely to appear when one or both of the parents are epileptic than when they are feeble-minded. When one parent was feeble-minded, and the other epileptic the proportion of epileptic to feeble-minded offspring of classifiable age was 28 epileptic to 26 feeble-minded, whereas when both parents were feeble minded the ratio was 7 epileptic to 29 feeble-minded. And the latter ratio is naturally much higher than the average, since only those families

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are considered in which there are some epileptic offspring. In many feeble minded stocks the proportion of epilepsy that appears is quite small. On the other hand most pedigrees which include a considerable number of epileptics contain also more or less feeble-mindedness.

In many pedigrees epilepsy shows a marked association with other neuropathic traits. As Weeks observes, "That there are more than five times as many epileptics as feeble-minded persons in these fraternities coming from matings where neither parent can be classed as normal, or called mentally defective, seems to indicate that neurotic or otherwise tainted conditions are more closely related to epilepsy than to feeble-mindedness."

From the available data it is far from evident that epilepsy is inherited as a single Mendelian character. "It will be seen from the present evidence," Weeks admits, "that epilepsy cannot be considered as a Mendelian factor when considered by itself, but that epilepsy and feeble-mindedness are Mendelian factors of the recessive type in that their germ cells lack the determiner for normality," however we are to imagine such an entity to occur. The statement of Davenport and Weeks concerning epilepsy and feeble-mindedness that "each is due to the absence of a protoplasmic factor that determines complete nervous development," and the further conclusion that "when both parents are either epileptic or feeble-minded all their offspring are so likewise," indicate that both these defects are due to the loss of the same factor. If so, epilepsy and feeble-mindedness should be hereditarily equivalent, which we have seen they are not. If they depend on the loss of different factors we should expect them to behave as independent characters in which case it would be perfectly possible for the mating of a feeble-minded and an epileptic to produce normal children; in fact we should expect most children to be normal. Neither of the authors mentioned seems to be sufficiently impressed with the dilemma into which their interpretations land them. There are indications that epilepsy is often recessive and that it is frequently inherited in an alternative manner, but we must be guarded on both these points. Davenport

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and Weeks seem to hold that while it is sometimes completely recessive, it is commonly only partly so, the simplex condition being indicated by milder forms of nervous disorder. For these authors almost any condition not quite normal may be indicative of the simplex type which includes neurotics, criminals, sex offenders, alcoholics, persons suffering from tuberculosis, migraine and apoplexy. In fact judging from the variety of so-called simplex types scarcely anyone would fail to qualify for this distinction. Inasmuch as epileptics sometimes come from parents classed as normal the presumption is that in some stocks the dominance of the normal condition must be variable. It is not improbable that some strains tend to transmit a more malignant type of the disorder than others. But we need more data on this point. Despite the evident labor involved in the work of Davenport and Weeks on the inheritance of epilepsy, the general results serve chiefly to emphasize the fact that very little is known about the subject. The uncritical way in which some of the work was done is clearly shown by the severe and somewhat acrimonious criticism to which it was subjected by Heron who pointed out numerous inaccuracies and contradictions throughout the original paper, as well as in the later contribution by Weeks.

The evidence that epilepsy is transmitted as a single unit character is entirely inadequate; there is only a certain presumption derived more from analogy than the evidence in hand, that it obeys Mendel's law; we are not clear how it is related in inheritance to feeble-mindedness, or other forms of defect. The evidence that epilepsy is strongly transmitted, however, is quite conclusive, whatever opinions may be held as to its precise mode of transmission.

INSANITY

For a long time it has been known that a proclivity to insanity may be inherited. At the same time it is universally conceded that people are often rendered insane through disease, injury or severe mental shock. Authorities vary remarkably in their

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estimations of the percentage of cases attributable to a hereditary diathesis. Toulouse (*Les Causes de la Folie*) cites a number of authorities whose estimates vary from 15.5 per cent to 90 per cent. Some writers have placed the percentage of insanity due to heredity often as low as 3 per cent. The disagreements are about as great among recent writers as among the older ones. Tanzi (*Mental Diseases*, p. 61) states that, "The percentages of heredity among the insane are not very high. To succeed in making them large, it is necessary to take into account metamorphoses from a nervous disease, or even from any disease, to a nervous disease, to consider anomalies as morbid processes, and to allow all cases of dissimilar heredity to pass as true heredity." And after commenting on the difficulty of securing data on the remote heredity of patients, Tanzi concludes: "If all these reservations be taken into consideration we arrive at the conclusion that, among the cases of insanity, the external act more widely than the internal." Paton in his work on *Psychiatry* tells us: "There is so much glib talk about the problems of heredity that the uninitiated are led to believe that a great deal is definitely known regarding the transmission of normal and abnormal mental traits; indeed, many alienists fail to appreciate our limitations in this respect. At present we do not possess an accumulation of carefully collected clinical data from which it is justifiable to draw any really valuable deductions, nor can the meagre facts recorded in the average clinical history be analyzed in such a way as to make clear their bearing upon the biological problems under discussion." Dr. Maudsley, who has given the subject particular attention, says: "The main value of the many doubtful statistics which have been collected by authors in order to decide how large a part hereditary taint plays in the production of insanity, is to prove that with the increase of opportunities of obtaining exact information the greater is the proportion of cases in which its influence is detected; the more careful and exact the researches the fuller is the stream of hereditary tendency which they disclose. Esquirol noted it in 150 out of 264 cases of his private patients; Burrows clearly ascertained that it existed in six-sevenths of the whole of

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his patients; on the other hand, there have been some authors who have brought the proportion down as low as one-tenth. Some years ago I made a tolerably precise examination of the family histories of 50 insane persons, taken without any selection; there was a strongly marked predisposition in 14 cases—that is, in 1 in 3.57, and in 10 more cases there was sufficient evidence of family degeneration to warrant more than a suspicion of inherited fault of organization. In about half the cases then was there reason to suspect morbid predispositions. I have recently inquired into the histories of 50 more cases, all ladies, the opportunities being such as could only occur in private medical practice, and with these results: that in 20 cases there was the distinct history of hereditary predisposition; in 13 cases there was such evidence of it in the features of the malady as to beget the strongest suspicion of it; in 17 cases there was no evidence whatever of it." In some cases insane ancestry was denied, but was subsequently found to exist. Dr. Maudsley thus expresses his general conclusion as to the proportion of insanity due to heredity: "Suffice it to say broadly that the most careful researches agree to fix it as certainly not lower than one-fourth, probably as high as one-half, possibly as high even as three-fourths." (*The Pathology of the Mind*, 3d edition.) Toulouse cites the estimates of various authors on the frequency of hereditary insanity as follows:

Ellis	15.5	per cent.
Morel	20	" "
Esquirol (Statist. de Charenton)	24.50	" "
Esquirol (Statist. de la maison d'Ivry)	56.81	" "
English Asylum Statistics	20.5	" "
Prussian Asylum Statistics	27.96	" "
Guislaid	45	" "
Moreau	90	" "

The following statements may be added from recent authors: Mott, "The large majority of the insane are hereditarily disposed." Clouston, "An evil nervous heredity commonly underlies all other causes. Without its existence there would be very

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little unsoundness of mind in the world." Mercier (*Sanity and Insanity.*) "The stability or instability of a person's nervous arrangements depend primarily and chiefly upon inheritance." Bianchi (*Textbook of Psychiatry*), speaking of epilepsy, says "Heredity plays the greatest part, and in most cases is direct and similar."

The great importance of the hereditary factor is emphasized by Heron who has made an elaborate statistical study of the inheritance of insanity based on data supplied by Dr. A. R. Urquhart, Superintendent of the James Murray's Royal Asylum, at Perth. "The records which have been compiled by Dr. Urquhart personally," says Heron, "are, therefore, of great value on account of their completeness, uniformity, and the long period over which they extend." The data showed that where both parents of an insane patient were sane, the ratio of the insane in all the offspring was 314:1179. With one parent insane the offspring were 93 insane: 299 sane, and when both parents were insane there were 4 insane and 4 sane offspring. Since not all the offspring had reached the age at which latent insanity might be manifested, it is obvious that the relative proportion of insane offspring would be considerably higher. Taking account also of data collected by Pearson, Heron concludes that his results "indicate that if *completed* histories are taken 40 per cent of insane offspring of insane parents is not an over-estimate, and that in this memoir we have erred on the side of lessening the intensity of inheritance in taking 25 per cent of the offspring of insane persons to be insane." Insanity, according to Heron, is inherited to about the same extent as stature, intelligence, and a number of other traits.

The way in which insanity is transmitted is rather more difficult to follow than the mode of inheritance of feeble-mindedness. Unlike the latter trait, insanity is seldom manifested until after the period of adolescence, and very frequently appears in middle life and even in old age. This circumstance creates a difficulty in the way of tracing the operation of any Mendelian factors which may be responsible for the insane diathesis, since a considerable

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proportion of people fail to reach the age at which their hereditary taint might become manifest, and since also it is necessary to know the whole life history of the individuals concerned.

Another difficulty is created by the fact that insanity may be produced by disease, trauma, alcohol, and various other causes. As Dr. Mott says, "Acquired syphilis, and in rare cases congenital syphilis, are now acknowledged to be the cause of the most terrible form of insanity: general paralysis. This disease is fatal a few years after the onset of symptoms; heredity plays relatively an unimportant part in its causation; it affects all classes in proportion to their liability to syphilitic infection."

The same authority states that "the cause of 20 per cent of the deaths in the London County Asylum is due to general paralysis," and that "we might add another 5 to 10 per cent of cases of brain disease dying in asylums with softening of the brain due directly or indirectly to syphilis." Guyer in speaking of general paresis states that "About twenty-two and five-tenths per cent of the first admissions to hospitals for the insane from city-dwelling men, and eight per cent from men living in the country in the state of New York are cases of this kind of insanity."

Not to mention other diseases and the various other assignable reasons why people become insane, it is evident that a very considerable percentage of the cases of insanity must be set aside in studying the rôle of heredity in the causation of this malady. Still another difficulty confronts the student of heredity in the circumstance that a hereditary proclivity to insanity may be present, but owing to favorable conditions of life and the absence of events that might upset an unstable nervous constitution, a person may escape falling a victim to his inherited defect. It is probable that a fair proportion of the hereditarily insane might have been saved from their unfortunate fate had they been properly shielded from adverse influences. According to many statistics, alcohol ranks high among the causes of insanity, but in most cases alcohol may have afforded the occasion which led to the derangement of a naturally unstable constitution. There has accumulated a great deal of evidence that the worst victims of

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alcohol inherit a weak or neurotic physique. The insanity, therefore, which is credited to the effect of alcohol is doubtless due in many cases to a vitiated inheritance. But it is practically impossible to measure the relative potency of the hereditary and environmental factors in such cases. And the same statement may be made with respect to the insanity attributed to worry, shock, childbirth, the menopause and the numerous other circumstances that unbalance the mind.

There are many forms of insanity differing greatly in their symptoms. Melancholia presents a picture very different from acute mania and dementia præcox. In fact the ills of the mind are almost as varied as the ills of the body. Like the latter they vary continuously in their degree of manifestation from the minor troubles that make people nervous, "a little queer," moody, or excitable, to raging mania or complete dementia. The hereditary forms, while naturally less numerous, present so many degrees of manifestation and so many variations that a satisfactory classification is a matter of great difficulty.

Some forms of insanity are closely associated with other diseases for which there is a strong heredity proclivity. This is the case with "epileptiform insanity," and to a less degree with "gouty insanity," "phthisical insanity," etc. To speak of hereditary insanity as a "unit character" due to a defect or loss of a single character in the germ plasm is about on a par with ascribing all kinds of heritable physical anomalies to the same cause. It may be true that a single defect in the germ plasm may manifest itself in a variety of ways and in many degrees. But analogy with the transmission of the bodily traits should make us very cautious about considering the insane diathesis as a unit character of essentially the same kind in the different cases in which it is manifested. Charts of the inheritance of insanity show that the afflicted individuals exhibit a great diversity of symptoms in successive generations. The possibility must, therefore, be borne in mind that the germ plasm of neurotic stocks may be affected in a variety of ways, and that the varied exhibitions of disordered mentality are the result, in part at least, of this circumstance.

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The first serious attempt to study the inheritance of insanity in the light of Mendel's law was made by Cannon and Rosanoff who carefully collected data from the families of 11 insane patients in the Kings Park State Hospital, New York. The authors employed the method of sending out field workers to study the families of the patients, and they were thus able to secure much more reliable data than that which is usually collected by hospitals and asylums. It was concluded that insanity behaves as a Mendelian recessive character. The expectations of this hypothesis that matings of insane with insane (RR×RR) would give nothing but insane offspring is quite consistent with the results. Out of three such matings yielding 16 offspring, 10 were neuropathic, 5 died in infancy, and data concerning the remaining one were wanting.

The mating of normal persons heterozygous for neuropathic defect, with neuropathics is represented, according to the authors, "by 19 matings with a total of 129 offspring. Theoretically one-half of these should be neuropathic, and one-half normal, but capable of transmitting the neuropathic make-up to their progeny. The charts show: 45 neuropathic, 14 normal with neuropathic offspring, 20 normal without offspring, 27 normal with normal offspring, 20 died in childhood, and concerning 3 data were uncertain."

This is not a very close approximation to the Mendelian expectation, under the assumption that we are dealing with DR×RR matings. Upon what basis is one of the parents considered heterozygous for the neuropathic taint? Evidently the authors have counted as heterozygous all those apparently normal persons who have produced neuropathic offspring when mated with a neuropathic person. This procedure affords a perfectly clear case of begging the question, for it assumes the truth of the conclusions to be established, and entirely overlooks the possibility previously pointed out, that the dominance of the normal condition may be variable or imperfect. On the assumption of Mendelian inheritance the only reliable index of the heterozygous make-up of the normal parent is that one of the

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parents is a neuropathic person (RR). On looking through the charts I find that only three of the 19 cases fulfill this condition. If one of the parents has a brother, sister or other near relative who is neuropathic, the assumption that this parent is heterozygous is only probable. In going over the charts for cases of this kind I find a record in the alleged DR×RR matings of only five instances. In all the other cases the conclusion is apparently based on no evidence at all beyond the fact that it is necessary to assume it in order to make the facts come out in accordance with the hypothesis.

The third class of cases discussed, the matings of a homozygous normal with a double recessive, DD×RR is represented according to the authors, by "five matings with a total of 18 offspring. Theoretically all the offspring of such matings should be normal, but capable of transmitting the neuropathic make-up to their progeny. The charts show: 8 normal with neuropathic offspring, 7 normal with normal offspring, 2 normal without offspring, and 1 died in childhood." The assumption that one parent is a homozygous dominant is naturally somewhat unsafe. From the nature of the case we can never know that this is correct, but from what has just been quoted it may be inferred that this assumption is made because all the children are normal, and some of the grandchildren neuropathic. Of course some of these cases cited may have been DR×RR matings which happened to have only normal (DR) children. What the authors have done is to divide up the cases in which normal and neuropathic mate into DD×RR and DR×RR in such a way as to best make the results fall into line with the theoretical expectations. That other interpretations are not improbable is evident from what has previously been said.

The alleged DR×DR matings turn out more in accordance with expectations since seven matings with 54 offspring yielded 12 neuropathic, and 34 normal individuals, and 8 who died in childhood.

A subsequent paper by Rosanoff and Orr deals in much the same way with a larger amount of data, represented by 73 pedi-

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grees including 206 matings and 1097 offspring. The same conclusions are expressed as to Mendelian inheritance of insanity. The authors recognize that while neuropathic traits are recessive, "various clinical neuropathic manifestations bear to one another the relationship of traits of various degrees of recessiveness; in a most marked way recoverable psychoses, though recessive as compared with the normal condition, are dominant over epilepsy or allied disorders."

Traits on the same level of recessiveness, but differing greatly in their clinical manifestations may bear to one another the relationship of "neuropathic equivalents." This, if true, makes Mendelian formulæ more elastic, but it increases the difficulty of proving that the inheritance is, in fact, Mendelian.

The authors show a commendable caution about concluding that the inheritance of insanity follows simple Mendelian rules. They say, "It seems necessary to assume that the normal development and function of the nervous system is dependent not upon a single unit determinant in the germ plasm, but upon a group of determinants, and that the number of units lacking from that group, determines the special type of defect to be observed clinically. It may be recalled that a similar assumption has been found necessary for the understanding of the inheritance of other Mendelian characters, notably various shades of skin pigmentation."

With commenting on the fact that it is not proven that the inheritance of skin color is Mendelian, although it is possible on certain assumptions to show how it might be so, or at least that it is not certain that it is not so, there seems to be no special reason for the particular conclusion, "That the number of units lacking from the germ plasm determines the special type of defect to be observed clinically." Analogy with Mendelian inheritance elsewhere would seem to make it more probable that the type of defect produced would depend upon the particular units of the germ plasm affected, and not merely upon their number. Perhaps the authors, who manifest an open-minded and candid attitude in dealing with the problem, would not object to this interpreta-

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tion. It certainly seems remarkable that many kinds of germinal defect would give rise to the same sort of neuropathic disorder. If so, one person might lack something necessary to normality and another person might lack something else, and yet the union of these persons might supply all that was needed to make a normal product. This would be clearly possible if the defects in question were completely recessive. One might expect, therefore, in view of the varied nature of hereditary insanity, that two insane, or at least two neuropathic persons might occasionally, if not frequently, produce a normal individual. The probability of such an occurrence would obviously depend upon the number of affected units in the germ plasm of the two persons, and the genetic similarity of the two types of hereditary defect. It would be of especial interest to compare the matings of similar neuropathic defectives on the one hand and dissimilar types on the other. Whether or not the latter types especially may not yield normal offspring we are not at present sufficiently assured. Matings of neuropathic and neuropathic, it is true, will produce a large proportion of neuropathic offspring. In the three cases of this kind given by Cannon and Rosanoff the parents were simply designated neuropathic, a term used to cover hysteria, feeblemindedness, epilepsy, convulsions or other pronounced manifestations, and the children of these matings which were all marked neuropathic showed insanity, epilepsy, convulsions and neuropathic states not further specified. In a paper by Rosanoff and Orr 17 such matings are recorded, resulting in 75 children of whom 11 died in infancy, 54 of the remaining 64 are given as "neuropathic," 10 being designated normal. In these 10 the authors state that in 2 cases "the neuropathic constitution is not insanity," and that the 8 others "have not reached the age of incidence."

There are several cases in which insane parents have been reported to have produced sane offspring. Pearson's family records give 66 per cent. insane offspring when both parents are insane. Only those children were classed as sane who reached an age of 50 years without developing insanity. Acquired insanity of

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the parents was not excluded in the statistics and the "sane" offspring may have been neuropathic in other ways.

Heron's data on this point are meagre and do not furnish information as to the age of the sane offspring, so it is not certain that they reached the period at which insanity would be developed. Goring gives three matings between insane parents, with 19 offspring, all sane, but we know little of their age beyond the fact that they were convicts.

Several writers have brought forward evidence that particular types of insanity tend to run in families. Berze reports a case of dementia præcox in a father and three sons; a case of a man, his daughter and her two children and several other instances with two or more in each family. Dr. Schuster from a statistical investigation of cases in the London County Asylums concludes that "a periodically insane son or daughter is more likely to be associated with a periodically insane mother or father than with one differently affected," and a similar association occurs between insane brothers and sisters. In delusional insanity "The tendency for the affliction to run in families is very marked" and "in the incidence of the primary dementia of adolescence there is a strong correlation between members of the same co-fraternity."

Strohmayer finds that manic-depressive insanity frequently reappears in much the same form. "Es gibt kaum ein Krankheitsbild, wo so einmutig die Macht des Erbfaktors anerkannt wird, wie beim manisch-depressiven Irresein. Alle Autoren heben den auffallend grossen Prozentsatz des durch Geisteskrankheit direkt oder indirekt belasteten Kranken dieses Schlages hervor. Die Angaben schwanken zwischen 75 und 85%. Ebenso stimmen alle Beobachter darin überein, das innerhalb des manisch-depressiven Gebeites die gleichartige verblüffend überweigt."

Many alienists from Morel to the present time have emphasized the extreme variability of the manifestations of mental defect and disease, and have found little tendency for the same type of insanity to repeat itself in successive generations. That particular forms of insanity are rarely transmitted as such is a doctrine which has been rather more frequently espoused in

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France than elsewhere, while in Germany, especially in the last two decades, the belief in a greater fidelity of transmission has become somewhat more prevalent. The diverse results obtained by different investigators on this question are in part due to different categories of classification adopted. It is generally recognized that a satisfactory classification of the varied forms of insanity has not yet been attained. In addition to a few broad types of insanity that are generally recognized there are so many cases whose grouping is at present an arbitrary proceeding that a certain amount of disagreement among different investigators is inevitable. However, with a closer study of symptoms and a more careful comparison of the insane who are members of the same family it is coming to be recognized by an increasing number of writers of all countries that there are some types of insanity which show a fair amount of constancy in their mode of transmission. This is in part due to the elimination in such studies of cases which are caused by external factors, such as syphilis, which is now known to be responsible for general paresis and a number of cases of insanity manifested in other ways.

Apparently, therefore, along with a considerable range in the manifestation of "neuropathic equivalents" there is a certain tendency for special types of mental disorder to perpetuate themselves.[1] It is a matter of great difficulty to determine how far different people with the same inheritance of neuropathic traits might come to differ in their symptoms. It is unfortunate that identical twins are not more common, since observation on a number of such twins with a neuropathic inheritance would throw much light on this problem.

There are a few cases of very similar types of insanity recorded in twins who were apparently identical (See Galton's *Inquiries*

[1] Among those who have emphasized the predominance of "similar" heredity are Griesinger, Ziehen, Albrecht, Sioli, Harbolla, Vörster, Schlub, Damköhler, Förster, Kreichgauer, Jolly, Pilcz, Berze, Myerson, Frankhauser. Of those holding to the predominance of "dissimilar" heredity may be mentioned Ribot, Demay, Urquhart, Schüle, Krafft-Ebing, Kraepelin (in earlier writings), Salgo, Leidesdorff, Moebius, Jung, Eibe, Grassmann, Krause, Lundborg, Liepmann, Bing, Krause, Croq, Déjérine, Bumke.

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into Human Faculty). One case of two twin brothers reported by Dr. Moreau is sufficiently striking to deserve quotation: "Physically the two young men are so nearly alike that the one is easily mistaken for the other. Morally, their resemblance is no less complete and is most remarkable in its details. Thus, their dominant ideas are absolutely the same. They both consider themselves subject to imaginary persecutions; the same enemies have sworn their destruction, and employ the same means to effect it. Both have hallucinations of hearing. They are both of them melancholy and morose; they never address a word to anybody, and will hardly answer the questions that others address to them. They always keep apart, and never communicate with one another. An extremely curious fact which has frequently been noted by the superintendents of their section of the hospital and myself is this: From time to time, at very irregular intervals of two, three, and many months, without appreciable cause, and by the purely spontaneous effect of their illness, a very marked change takes place in the condition of the two brothers. Both of them, at the same time, and often on the same day, rouse themselves from their habitual stupor and prostration; they make the same complaints, and they come of their own accord to the physician, with an urgent request to be liberated. I have seen this strange thing occur, even when they were some miles apart, the one being at Bicêtre, and the other living at Saint-Anne."[1]

According to Schlub three-fourths of the cases of insanity occurring in siblings is of the same type. The percentages of like

[1] Bajenoff (Quelques réflections sur les folies gémellaires et familiales, *Arch. internat. de Neur.*, 11, s. I. 213–218, 1913), cites a number of cases of similar insanity in twins; in one case reported by Harandon de Montyel two twin girls, apparently identical, were married on the same day and became pregnant at about the same time. Both were taken with delirium in early pregnancy and were confined separately in the same asylum without either being apprised of the condition of the other. Their insanities were pronounced "absolutely identical"; their hallucinations were much the same and their spells occurred at the same time. They were delivered within 48 hours of each other and soon afterward the insanity in both subsided. Schultes (Ueber Zwillingspsychosen, *Allg. Zeit. f. Psychiat.*, 1913, 348–364), reports on five cases of insanity in twins; four of these which were very similar twins showed the same types of insanity.

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forms of insanity was found to be higher (90 per cent) among brothers than among sisters (70 per cent) or between brother and sister (68 per cent). Where insanity occurred in twins it was of the same type whether the twins were of the same sex or not. (*Zeit. f. Psychiat.* 66, 514–541, 1909). Similar findings have been recorded by H. Krueger (*Zeit. f. d. gesamte Neurol. u. Psychiat.* 24, 113, 1914).

Is insanity transmitted as a typically recessive trait? In Huntington's chorea it is generally conceded that we have a character that usually behaves as a typical dominant. But most of the writers who have considered insanity from the Mendelian standpoint conclude, often in a guarded and tentative manner, that most forms are recessive. One fact that on the face of it indicates that such is the case is that insanity and other neuroses frequently arise in families in which the parents are normal or slightly neuropathic, and that the frequency of such cases is increased when the presence of insane or neuropathic relatives points to the heterozygous constitution of the parents. When, however, we are dealing with a character so protean as the "neuropathic constitution" is commonly assumed to be, this evidence becomes somewhat less convincing.

The neuropathic constitution may take a relatively mild form in the parents in which it escapes being recognized, while in the offspring it may take the form of insanity. A trait essentially dominant will, if highly variable in its manifestations and especially if the degree of its manifestation is largely dependent upon environmental factors, closely simulate a recessive trait in its mode of occurrence.

To speak of insanity as a defect and as, therefore, due to the loss of one or more determiners in the germ plasm is misleading. Properly, in our view, it is neither the one nor the other. It is more probable that the hereditary basis of insanity is something positive, a definite pathological factor or factors working havoc with the normal development of the organism, and which may be kept from exercising to the full its deteriorating effects by an admixture of healthy germ plasm. How far insanity is the prod-

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uct of specific neurotoxins, it is at present impossible to say. There is little in the symptoms of insanity that would lead us to conclude that it is the expression of mere weakness or lack of something, any more than is rheumatism or the gout.

It is one of the unfortunate influences of the presence-absence theory that it leads people to jump to the conclusion that traits may be due to absences and hence recessive when there is no clear evidence of this from the facts in hand. Imperfect dominance is sufficiently plentiful among organisms in general to make us expect it more or less frequently in the inheritance of neuropathic traits. Davenport and Weeks, as we have seen, conclude that it occurs in the transmission of epilepsy and related neuroses. An examination of the charts in Rosanoff and Orr's paper on the inheritance of insanity shows that all the facts may plausibly be interpreted according to the same hypothesis. The frequency with which the matings of normal and neuropathic parents produce neuropathic offspring is rather better in accord with this view. On the assumption of complete recessiveness Rosanoff and Orr are led to the view that over 31 per cent of apparently normal people are carriers of neuropathic defect. In most of the cases given by Rosanoff and Orr where the mating of a normal and a neuropathic resulted in neuropathic offspring, it was not possible to show that the normal parent was in fact heterozygous; he was simply assumed to be so on account of the character of the offspring. It is evident that if neuropathic traits are imperfectly dominant, or not completely recessive (which is the same thing) it is not necessary to assume that the heterozygous condition is nearly so prevalent. Matings of apparently normal stock with one that is neuropathic are so often followed by unfortunate results that one is naturally led to suspect that a partial blending or direct contamination, is a phenomen of common occurrence.

THE ALLEGED PRINCIPLE OF "ANTEDATING" OR "ANTICIPATION"

Dr. F. W. Mott has pointed out what he considers to be a principle of general application in neuropathic inheritance,

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namely, the so-called process of "antedating" or "anticipation." "I have found," he says, "that there is a signal tendency in the insane offspring of insane parents for the insanity to occur at an earlier age and in a more intense form in a large proportion of cases; for the form of insanity is usually either congenital imbecility or the primary dementia of adolescence, which generally is an incurable disease." The consequence of this alleged tendency is that, with increasing age, the offspring of insane parents become less liable to insanity. "Besides the fact," continues Dr. Mott, "that this shows Nature's method of eliminating unsound elements of a stock, it has another important bearing, for it shows that after the age of twenty-five there is a greatly decreasing liability of the offspring of insane parents to become insane, and therefore on the question of advising marriage of the offspring of an insane parent this is of great importance. Sir George Savage recently said in his presidential address that this statistical proof of mine accorded with his own experience, and that if an individual who had such an hereditary taint had passed the age of twenty-five, and never previously shown any signs, he would probably be free, and he would offer no objection to marriage."

If on the basis of the principle of anticipation advice is to be given on the subject of marriage, it is well to be assured that the principle rests upon a firm foundation. Dr. Mott arrived at his conclusion in the following way: He examined the age at the time of the first attack of insanity of 508 pairs of parents and offspring. In 47.8 per cent of the offspring the first attack occurred before the age of twenty-five. "In 299, or 58.8 per cent, of the 508 pairs of insane parents and offspring, the first attack in the offspring occurred at an age twenty or more years earlier than in the parents; of these 299 instances 73 of the offspring were imbeciles."

Professor Karl Pearson in a letter written to *Nature* (Nov. 21, 1912) showed that Mott's principle of anticipation involved a statistical fallacy. It was pointed out that a man or woman who develops insanity at an early age is not so likely to become a

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parent as one who becomes insane at a later age. The parents, therefore, would constitute a group selected on the basis of age. More detailed criticism of "antedating" was made by Heron (*Biometrica*, 10, p. 356) who showed that Mott's data made no allowance for the probability that many of the normal siblings of the insane offspring of insane parents might subsequently develop insanity. Also the fact that parents and offspring who happen to be insane at nearly the same time would be apt to be in the same asylum introduces a third source of error, because in such a case we should be apt to find insanity developing late in the parents and early in the offspring. Considering all these statistical fallacies involved, the principle of anticipation cannot present much claim to acceptance. It would indeed be unfortunate if advice concerning marriage should be given on the basis of so questionable a generalization.

SHOULD STRENGTH MATE WITH WEAKNESS?

In Bulletin No. 9 of the Eugenics Record Office the statement is made that the "proper mating" of a neuropathic person "is with a person in whose ancestry there is no trace of neuropathic ancestry," and that "if only the matings be carefully made so that the immediate children of the neuropathic person shall avoid marrying a consort with a neuropathic taint, there will be no neuropathic children or grandchildren, and hardly a greater chance of neuropathic great-grandchildren than though the marriage in question had not been made." "The case may well arise," Dr. Davenport continues, . . . "where a mentally vigorous man wishes to marry a socially attractive and beautiful, though defective, woman. Such a marriage may be, from the standpoint of Eugenics, as from any social viewpoint, quite permissible." And in speaking of the marriage of epileptics, it is further stated that "there may arise cases where the marriage of an epileptic to a person of mentally untainted stock would be, on the whole, desirable."

The advice that strength may mate with weakness has been

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severely criticized, and justly so, by Pearson, Heron, Saleeby, and others. Granting that mental defect is transmitted as a single recessive unit character, the mating of a duplex normal with a defective, while producing normal children, nevertheless makes them carriers of the defect. Should two such carriers mate, one-fourth of their offspring would manifest the defect; should the carriers follow the "eugenic rule" and mate with defectives, half of their offspring would be defective. Matings of normal and defective simply sow the seed for future trouble. Should the estimate of some of the workers of the Eugenics Record Office prove correct, namely, that over 30 per cent of the population is heterozygous for mental defect, the direct danger of such matings is very considerable. Certain defects are distributed widely enough as it is, without our advising marriages that would simply make the situation worse. Nothing could be more inconsistent with everything we know of heredity than the ill-considered advice that strength may mate with weakness.

And besides we have very little assurance that the normal condition dominates mental defectiveness to the extent that is usually assumed. I have been continually surprised in reading papers on the Mendelian inheritance of mental defect to find how placidly and uncritically the assumption is made that normal mentality behaves as a typical dominant. It does not seem to occur to most of those who have treated the subject that the children of a mental defective are apt to be severely injured by the incompletely suppressed traits of that parent, however free from taint the ancestry of the other parent may have been. And this in spite of the fact that Mendelian literature is full of cases of incomplete and variable dominance! Surely from the facts at our disposal no one is justified in feeling very confident of the complete dominance of mental normality. The injury resulting from the mating of mental soundness with mental weakness may be very direct, manifesting itself in the production of children mentally inferior or suffering from various neuropathic taints. It is not at all unlikely that many of them would actually be ranked as mental defectives or be caused by untoward circum-

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stances to fall victims to insanity. Not improbably the very large number of cases in which the mating of normal and feeble-minded produce children of the latter class are due not so much to the heterozygous character of the putative normals as to partial blending, or irregular and incomplete dominance. As our previous discussion has shown, where one parent is feeble-minded or insane, and the other normal, it is quite exceptional for all the children to be free from the mental taint of the afflicted parent.

SYPHILIS AND MENTAL DEFECT

The rôle of syphilis in the causation of feeble-mindedness, epilepsy, and other forms of mental defect is still uncertain, despite a considerable amount of investigation devoted to the subject. Formerly syphilis was not considered to be accountable for a large percentage of mental defect, because only a small proportion of defectives were found to manifest any obvious signs of the disease. Since the discovery of the Wassermann and other tests it has been possible to detect syphilitic infection in numerous cases in which the disease was not revealed by any external symptoms. The Wassermann test, however, is apt to give very different results according to the particular way in which it is carried out. It is agreed that the absence of the positive Wassermann does not necessarily indicate the absence of syphilis, but a positive test except in the presence of a few other diseases or unusual conditions is held to constitute a strong proof that syphilis is present. Applications of the Wassermann tests to mental defectives have yielded surprisingly discrepant results. Goddard, in his work on feeble-mindedness, states that less than 1 per cent show syphilitic infection. Thomson, Boas, Hjort and Leschly in studying 2,061 mental defectives found that only 1.5 per cent gave a positive Wassermann reaction. Lippmann found 9 per cent of positive reactions in one asylum, and 13 per cent in another. Dean found that out of 330 idiots of various ages in Potsdam 15 per cent were syphilitic. Krober obtained positive results in 21.4 per cent of 262 idiots.[1]

[1] Reference may also be made to the work of Atwood and Brofenbrenner who by

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One of the highest percentages of positive reactions was found by Fraser and Watson. These workers not only applied the test in a thorough manner, but they studied the family history of the patients, and applied the Wassermann test also to other members of the family. Dr. Fraser examined the blood sera of 99 mentally defective and epileptic children. Excluding 10 cases of epilepsy where no apparent mental defect existed, and "considering only the 89 cases where defect was present, it was found that 40 gave a positive reaction, or 44.9 per cent.; 38 gave a negative reaction, or 42.4 per cent.; and 11 gave a doubtful reaction, or 12.3 per cent."

In several cases in which the child gave a negative or doubtful reaction it was found that a positive Wassermann could be obtained from some other member of the same family, thus affording evidence that syphilitic infection was or had been present in the child examined. Considering all the evidence in hand it is probable that the percentage of syphilitic infection was over 57 per cent.

An examination by Dr. Watson of the blood serum of 105 cases of mental deficiency, mainly feeble-mindedness, of varying ages up to 17 years showed that 51 gave a positive reaction, 45 gave a negative reaction, and 9 were doubtful. As several of the negative or doubtful cases had relatives that gave a positive reaction, it is probable that the percentage of syphilis in Dr. Watson's group of defectives was over 50 per cent. "On grouping the defective and epileptic children together, it is found that of the 205 cases examined syphilitic infection is present in 126 or 60 per cent."

Should syphilis be found to play so large a part in the pro-

using the Noguchi system in the examination of 204 idiots found 14.7 per cent that gave a positive reaction. Raviart, Breton and Petit in examining various cases of mental defect aside from parasyphilitic cases obtained positive reactions in 30 to 40 per cent of all cases of idiocy, epilepsy and imbecility. A high proportion of positive cases was found in various forms of insanity by Rosanoff, Wiseman and Noguchi. (See Noguchi, *Serum Diagnosis and Luetin Reaction*, Philadelphia, 1912.) Kaplan (*Serology of Nervous Diseases*, 1914), found a positive Wassermann in 4 out of 38 epileptics and a negative reaction in most cases of dementia præcox and manic-depressive insanity, and he emphasizes the danger of reporting too many cases of a positive reaction.

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duction of mental defect as the researches of Fraser and Watson indicate, it would necessitate considerable modification of the views that have been expressed regarding the so-called Mendelian transmission of epilepsy and feeble-mindedness. Very many of the charts picturing such inheritance are quite consistent with the hypothesis that we are dealing with the transmission of an infection which produces effects of various degrees of severity. Where both parents are infected we should expect that the children would be severely afflicted. The matings of normal and defective, however, do not turn out quite as we should expect on the theory of infection. It is highly desirable that future studies of the inheritance of mental defect may make use of thorough tests to eliminate the possibly very large factor of syphilis. This has not been done in any of the work published by the Eugenics Record Office, and it remains to be seen what basis will be left for the various laws that have been laid down for the inheritance of mental defect when this precaution has been taken.

THE NOTION OF DEGENERACY

Since Morel published his celebrated treatise on Degeneracy in 1857, it has been a prevalent idea that many forms of defect and disorder are not transmitted as such, but may give place in the descendants to abnormalities of the most varied kind. What is transmitted is held to be a degenerate constitution which may be manifested in diverse ways according to circumstances. "Heredity," says Morel, "does not mean the very disorders of the parents transmitted to the children with the identical mental and physical symptoms observed in the progenitors. It means transmission of organic dispositions from parents to children. Alienists have, perhaps, more frequent occasion than others for observing not merely this heredity transmission, but likewise various transformations which occur in the descendants. They are aware that simple neuropathy (nervous tendency) of the parents may produce in the children an organic disposition resulting in mania or melancholia, nervous affections which in turn may

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produce more serious degeneracy and terminate in the idiocy or imbecility of those who form the last link in the chain of hereditary transmission."

Dr. Moreau, a prominent member of the same school, tells us that "it is not in the identity of functions, or of organic or intellectual facts that we must seek the application of the law of heredity, but at the very fountain head of the organism, in its inmost constitution. A family whose head has died insane or epileptic does not of necessity consist of lunatics and epileptics, but the children may be idiotic, paralytic, or scrofulous. What the parents transmit to the children is not insanity, but a vicious constitution which will manifest itself under various forms in epilepsy, hysteria, scrofula, rickets, etc. This is what is to be understood by hereditary transmission."

The same idea is emphasized by Féré in *La Famille Neuropathique*. "Le plus souvent, la maladie qui se transmet se transforme; c'est ainsi qu'on voit succéder la manie, la mélancolie, l'imbécillité, l'idiotie." The lack of fidelity which characterizes the transmission of defect is regarded as a result of the "dissolution of heredity" occasioned by a lack of developmental energy (defaut d'energie émbryogenique). "La dégredation de la puissance émbryogenique, démontrée par la fréquence de malformations variées, et en fin de compte par la stérilité dans les races dégénérées permet de comprendre á la fois l'hérédité morbide dissemblable, et l'hérédité morbide collaterale." But, as Féré hastens to add, the sequences of degenerative changes do not follow without rhyme or reason. There is a more or less definite grouping of symptoms constituting a family of related defects. "La dégénérescence a ses lois comme l'évolution normale; quelle que soit sa cause, elle se manifeste sous un petit nombre de formes communes."

If degeneration is due to a general defect of developmental energy or the presence of factors which exercise an injurious influence upon the evolution of the embryo, its protean manifestations need not surprise us. One of the most conspicuous features of the results of experimentation upon the effects of external

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agencies on embryonic development is the great variety of anomalies which are produced in response to any one agency. Féré's interest in the causation of innate defect led him to consider the problem of how development may be influenced by external factors, and accordingly we find the author of the *Pathology of the Emotions* and various other treatises on abnormal psychology and nervous disorders, writing numerous notes upon the effect of all sorts of agencies upon the development of the egg of the domestic fowl. Injurious agencies generally effect a retardation of development and the production of various anomalies; more rarely there are produced individuals defective in certain respects but presenting in general a superior development.

There is a certain parallelism between the manifestations of morbid heredity and the pathological effects of injurious agencies. Just as certain substances produce a great variety of teratological effects in the developing embryo, so certain hereditary factors result in very diverse characters in the adult organism. The toxins of a chronic disease such as syphilis produce a bewildering multiplicity of symptoms, and it should occasion no surprise that certain inherited tendencies should do likewise. If there be hereditary factors whose effect on development is to produce a general retardation and deterioration after the manner of the toxic influence of some chemical substance, the manifestations of these factors in successive generations might take the form of stigmata of degenerations as varied as those which occur in many families of defective human beings. Féré speaks of such phenomena as indicative of "the dissolution of heredity," as if we were dealing with something which weakened or broke up the force of embryogenic energy. Perhaps the germ plasm of certain individuals may contain elements which tend to destroy the fidelity of hereditary resemblance, although it may be questioned whether this would in strictness be a dissolution of heredity.

It is, of course, possible to maintain that the multiplicity of degenerative phenomena in human beings is the result of various unit factors each of which tends to produce a particular kind of defect. However true this may be in regard to certain character-

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istics, it cannot, I think, be considered as a probable general conclusion in the light of our present knowledge. For many of the so-called stigmata of degeneracy there is little or no positive evidence of transmission as particular characters apart from the general complex. The apparent substitution of one anomaly for another and the fact that certain forms of anomalies are apt to be correlated with certain others, although not showing a constant correlation, point to the conclusion that in most anomalies we are dealing with symptoms of heritable defect instead of hereditary characters *per se*. Féré who has brought together a number of cases of this "malformation multiples" comments on "la coincidence du bec-de-lièvre avec l'infantilisme, avec la polydactylie et le pied bot, ou avec la syndactylie et d'autres vices de conformation des extrémités, de la polydactylie avec le coloboma de l'iris et la rétinite pigmentaire," and many other associations some of which may rest upon mere coincidences.

One is, of course, not justified in lumping all sorts of defects together as the result of a single tendency to degeneration. There are indications of types of degeneracy within which certain stigmata are particularly prone to appear while other types of degeneracy are apt to be manifested by other groups of symptoms. The protean manifestation of certain types of defect makes the analysis of the phenomena a matter of unusual difficulty, and one which is often further complicated by association with the likewise protean manifestations of hereditary syphilis. The following family history reported by Kiernan and described in Talbot's *Degeneracy* will forcibly illustrate this point: "A farmer lived twenty miles distant from his nearest neighbor, whose only child he married. . . . He then found lead on his farm and went to a city . . . where he made money more as a cunning tool than an adventurer. He became a high liver, gouty and dyspeptic, and died with symptoms of gouty kidney at 70. The couple had five children. The eldest, a son, became a 'Napoleon of Finance,' . . . He married a society woman, the last scion of an old family. The second child, a daughter, was club-footed and early suffered from gouty tophi. She married a society man of old family who had

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cleft palate. The third child, a daughter, had congenital squint. She married a man who suffered from migraine of a periodical type. The fourth child, a daughter, was normal. She married a thirty-year-old active business man, in whom ataxia developed a year after marriage. The fifth child, a son, was ataxic at eighteen. The children of the 'Napoleon of Finance' and the society woman were an imbecile son, a nymphomaniac, a hysteric, a female epileptic who had a double uterus, and a son who wrote verses and was a society man. The cleft-palated society man and club-footed woman had triplets born dead and a squinting, migrainous son who, left penniless by his parents, married his cousin, the nymphomaniac daughter of the 'Napoleon of Finance,' after being detected in an intrigue with her. The migrainous man and squinting daughter of the farmer stock-broker had a sexually inverted masculine daughter, a daughter subject to periodical bleeding at the nose irrespective of menstruation, as well as chorea during childhood, a normal daughter, a deaf-mute phthisical son, a daughter with cloacal formation of the perineum, an ameliac son, a cyclopian daughter (with one central eye) born dead, and, finally, a normal son. The sexual invert married the versifier son of the 'Napoleon of Finance.' The progeny of the normal daughter of the farmer stock-broker and the ataxic husband were a dead-born, sarcomatous son, a gouty son, twin boys paralyzed in infancy, twin girls normal, a normal son, and a son ataxic at fourteen. The progeny of the nymphomaniac daughter and her strabismic, migrainous cousin were a ne'er-do-well, a periodical lunatic, a dipsomaniac daughter who died of cancer of the stomach, deformed triplets who died at birth, an epileptic imbecile son, a hermaphrodite, a prostitute, a double monster born dead, a normal daughter and a paranoiac son."

Aside from the evidences of luetic infection in some branches of this unfortunate family, there is a combination of traits, some of which, as bleeding and color blindness, are commonly transmitted as so-called "unit characters," while others are symptomatic of defective tendencies which might find expression in a multitude of forms.

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Doubtless the writers who attribute so much to degeneracy have often failed to recognize traits which are separately transmissible. But on the other hand, exclusive attention to the inheritance of particular characteristics leads to a disregard of other features of organisms which may be associated with the characters studied. Most studies made upon the Mendelian inheritance of human traits suffer from this drawback. Inspired by the desire to apply Mendel's law to all heritable traits, Mendelians have focussed their attention almost exclusivily upon particular characters in the hope of unravelling the complex skein of human inheritance by tracing out the individual traits. With fuller experience with Mendelian phenomena it is coming to be recognized by many investigators that "characters" are not entities by themselves, but symptoms of general and deep-seated though it may be slight modifications. As Dr. T. H. Morgan says: "Most students of genetics realize that a factor difference usually affects more than a single character. For example, a mutant stock [of Drosophila] called rudimentary wings has as its principle [principal] characteristic very short wings. But the factor for rudimentary wings also produces other effects as well. The females are almost completely sterile, while the males are fertile. The viability of the stock is poor. When flies with rudimentary wings are put into competition with wild flies relatively few of the rudimentary flies come through, especially if the culture is crowded. The hind legs are also shortened. All these effects are the results of a single factor-difference." Such flies may be called degenerates; whether they are more variable than robust races we do not know.

There is no doubt that many writers of a generation or more ago employed the notion of degeneracy in too wide and loose a sense. Nevertheless there may be an important element of truth in the idea which is apt to be overlooked by modern geneticists in their preoccupation with the transmission of particular and clearly definable characteristics. A more critical study of degenerate strains of plants and animals might afford valuable suggestions for the interpretation of many phenomena of human heredity.

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CHAPTER IV

THE HERITABLE BASIS OF CRIME AND DELINQUENCY

"Si la pauvreté est la mère des crimes, le défaut d'esprit en est le père."—La Bruyère, *De l'Homme.*

STRICTLY speaking it is of course absurd to speak of the inheritance of criminality. Crime is an offense against law. What is crime in one age and country may not be crime in another. No one is a criminal until he commits a crime, and whether or not a person so acts as to bring himself into conflict with the law of the land is obviously dependent upon many circumstances. Under just the proper combination of conditions, doubtless most of us might have become criminals, for a time at least.

While crime is in a very large degree a product of bad training and evil surroundings, some individuals may have, in a much greater degree than others, certain traits which dispose them to commit criminal actions. What a man does is the result of both hereditary and environmental factors. The recognition of the fact that the criminal is not merely a sinner to be punished, but a product to be scientifically studied and understood, is gradually leading to a new attitude toward the phenomena of crime. As judged by many modern students of the subject, crime belongs largely in the field of pathology. Where it is not to be attributed to bad education or environment it is charged to abnormal heredity.

Since the publication of Morel's treatise on degeneration, there has been an increasing amount of attention paid to the various physical characteristics which are supposed to stigmatize the natural-born criminal. Among the foremost of the students of criminal anthropology is Lombroso whose anthropometric studies of numerous criminals in Italian prisons convinced him of the

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existence of a definite type,—a kind of human being endowed with a peculiar physical organization and with instincts which powerfully dispose him to commit anti-social acts. Such individuals seem predestined to a life of crime from the day of their conception. They take to it as a cow takes to pasture, because of the impelling force of unconquerable instinct.

Lombroso's early study of psychiatry gradually led him into the field of anthropometry. He began a series of studies on the physical and mental characteristics of Italian prisoners and having had occasion to make a post-mortem study of a famous brigand, Vilella, he was struck with certain anomalies of the brain and particularly with a depression situated "precisely in the middle of the occiput as in inferior animals, especially rodents." "At the sight of that skull," says Lombroso, "I seemed to see all of a sudden, lighted up as a vast plain under a flaming sky, the problem of the nature of the criminal—an atavistic being who reproduces in his person the ferocious instincts of primitive humanity and the inferior animals. Thus were explained anatomically the enormous jaws, high cheek-bones, prominent superciliary arches, solitary lines in the palms, extreme size of the orbits, handle-shaped or sessile ears found in criminals, savages, and apes, insensibility to pain, extremely acute sight, tattooing, excessive idleness, love of orgies, and the irresistible craving for evil for its own sake, the desire not only to extinguish life in the victim, but to mutilate the corpse, tear its flesh, and drink its blood."

Further studies carried on with much industry and enthusiasm served to confirm Lombroso in his interpretation of the born criminal as an atavistic product. It would be unjust to represent Lombroso, as some of his critics have done, as teaching that all or even a large majority of offenders are born criminals. He is perfectly well aware, and has clearly stated, that many who are led into crime are the victims of untoward influences, but he insists that there is a class of human beings of degenerate inheritance, and distinguished by certain physical and mental peculiarities, who constitute a so-called criminal type. And he is careful

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to explain that by type he does not mean a pattern to which all born criminals conform. The type, as in comparative anatomy, is an ideal construction from which the actual embodiments depart to a greater or less degree. Some of the stigmata that characterize the born criminal may fail in one offender and others may be lacking in others. "In normal individuals," says Madame Ferrero, the daughter and approved interpreter of Lombroso, "we never find that accumulation of physical, psychical, functional and skeletal anomalies in one and the same person that we do in the case of criminals, among whom also entire freedom from abnormal characteristics is more rare than among ordinary individuals."

"Just as a musical theme is the result of a sum of notes and not of any single note, the criminal type results from the aggregate of these anomalies which render him strange and terrible, not only to the scientific observer, but to ordinary persons who are capable of impartial judgment."

The instinctive suspicion that we entertain of certain bad characters is held to be an indication of the existence of physical signs of criminality. Popular sayings offer evidence of this as is indicated by the following: "There is nothing worse under Heaven than a scanty beard and a colorless face." "The squint eyed are on all sides accursed." "A turned up nose is worse than hail." "Beware of him who looks away when he speaks to you."

Among the marks said to be characteristic of criminals are anomalies in the size and shape of the skull, large face with prominent cheek bones and jaws, asymmetry of the face, ears, and eyes, drooping or oblique eyelids, and eyes with a hard expression and shifty glance, large misshapen ears frequently with Darwin's tubercles, twisted nose, aquiline in murderers, but flattened and upturned in thieves, palatal ridges, anomalous teeth, scanty beard, and relatively long arms. In the brain anomalies are frequent, such as hypertrophied vermis, doubling of the fissure of Rolando, and peculiarities of the cells, especially in the frontal lobes. Certain kinds of criminals, such as murderers, are supposed to differ in their stigmata from others, such

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as thieves. Many of the stigmata, like the third trochanter, polydactylism, perforate head of the humerus, etc., occur only in a small percentage of cases, but more frequently than in normal persons.

According to Lombroso most of the senses of criminals, except sight, are dull. There is an insensitiveness to pain which in certain cases is very striking. Criminals are commonly impulsive and may at times act with much energy, but they are generally lazy. Moral sense and natural sympathies are at a low ebb. Remorse seldom afflicts the born criminal. Vindictiveness, cruelty and excessive egotism and vanity are common traits. Intelligence, generally subnormal, may be well developed in some instances; as a rule criminals show a lack of prudence and forethought which often serves the ends of justice through causing failure adequately to conceal the evidences of crime.

Lombroso regards the born criminal as an atavistic product. Many of the stigmata are said to represent characteristics found in the lower animals or among the savage races of mankind. The born criminal is a brute or savage living among human beings who have advanced beyond his stage of development. He represents a survival of a primitive type.

Lombroso recognized, especially in his later writings, that certain criminals are to be regarded as pathological products rather than cases of atavism. An important rôle is attributed to insanity and especially epilepsy in the causation of crime, and the effort is made to establish a fundamental relationship between epilepsy and the atavistic traits of the born criminal. "Criminality," says Lombroso, "is an atavistic phenomenon which is provoked by morbid causes of which the fundamental manifestation is epilepsy. It is true that criminality can be provoked by other diseases . . . but it is epilepsy which gives to it, by its gravity, the most extended basis."

The experience of Lombroso and other investigators shows that epilepsy is much more prevalent in criminals than among normal individuals, although not so common as Lombroso's doctrine would lead one to expect. This fact he attempts to account

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for by the theory that epilepsy of criminals commonly exists in an attenuated or modified form. "If fully developed epileptic fits are often lacking in case of the born criminal, this is because they remain latent under the influence of the causes assigned, (anger, alcoholism), which bring them to the surface. With both criminals and epileptics there is to be noted an insufficient development of the higher centres. This manifests itself in the deterioration in the moral and emotional sensibilities . . . and especially in the lack of balance in the mental faculties, which, even when distinguished by genius and altruism, nevertheless always show gaps, contrasts, and intermittent action."

The investigations and theories of Lombroso greatly stimulated the study of criminology and formed the starting point of a school, the so-called positive school of criminologists, which has been particularly active in collecting data on criminal anthropology. The doctrines of this school have been vigorously opposed by other students of crime, especially by Tarde, Topinard, and more recently Goring whose work on *The English Convict* represents perhaps the most thorough biometric investigation of criminals that has yet been made. If the members of the positive school went too far in representing the born criminal as a member of a distinct atavistic type, they did valuable service in directing attention to the fact that crime often has a basis in physical and mental abnormality, and in paving the way for a true science of criminology.

The notion of atavism in the sense in which it figures so largely in the theories of the positive school is one which is no longer adopted by most modern workers in genetics. The reversion which follows upon the restoration of ancestral conditions in the germ plasm by the combination of complementary factors in the crossing of different races of plants and animals, is a phenomenon quite different from the so-called atavistic peculiarities of criminal man. Much of what appears like atavism may result from arrested development occasioned by various pathological causes. And many deviations from normal structure which, if they do not happen to resemble conditions occurring in one animal may be

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like something found in another, do not necessarily have any connection with reversion at all, but are simply the consequences of an abnormal inheritance, or the toxins of disease.

To the extent that the born criminal deviates from normal man his peculiarities are to be regarded as the result of aberrant rather than reversionary development. The biometric studies of the English convict by Goring have shown that these deviations are much less frequent than is commonly represented by the positive school. Goring's work was based upon careful measurements of three thousand criminals committed to prisons for various kinds of crime. A comparison was made of thirty-seven physical attributes in five different classes of criminals with the end of ascertaining whether or not these classes could be distinguished by any average differences of structure. For the most part when allowance was made for average age and other differences in the classes compared, the differences in the physical characters of the five groups were so small that no particular significance could be attached to them. In certain respects, however, differential characteristics were found. Those convicted of crimes of violence are superior to other kinds of criminals and to the general population of corresponding age in physical strength and health. Next come the sexual offenders; thieves and burglars occupy an intermediate position; while those guilty of forgery, fraud and damage to property are least developed in muscular strength and have the poorest health. Criminals convicted of forgery and fraud are of the greatest average height, while thieves and burglars are inferior in stature as well as weight and "puny in their general bodily habit." Aside from general differences in physique, such as height, weight, obesity, strength and health, there are no anatomical peculiarities which differentiate criminals of different types or which serve to distinguish criminals in general from the average run of mankind.

The criminal anthropologist might urge that the variations among criminals, which are admittedly in all directions, might tend to cancel one another in the statistical average and hence fail to reveal the greater preponderance of physical anomalies that

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characterize the criminal type. Statistical methods, however, provide a means of testing such a supposition by enabling us to compare the standard deviations of the characteristics tabulated. The standard deviation, a measure of the average departure of individuals from the mean of the group, gives us a precise measure of the variability of the group dealt with. By comparing the standard deviations of the curves of variability for any measurable character in criminals and non-criminals it can be determined which class of men exhibits the greater average degree of variation. This method is much more precise and valuable than the loose enumeration of particular cases which is so often found in writings on criminal anthropology. When applied to criminals by Goring (he applied the standard deviation for thirty-seven physical characters both in the criminal sub-groups and in the criminal group in general), it was found that the characters of the sub-groups of criminals had much the same range of physical variability, and that criminals as a whole compared with different classes of non-criminals fail to show any significantly greater range of variation in the physical features of which measurements were obtained.

The doctrine that the born criminal is an anomalous, atavistic creature set apart from the rest of mankind by the possession of a physical and mental organization that inevitably disposes him to evil is rejected as without adequate basis of fact. "There is no such thing as an anthropological criminal type."

But while denying the existence of a specific type of criminal, Goring is careful to state that criminals are discriminated from the law-abiding public by certain general physical and mental characteristics. His standpoint is best stated in his own words: "Reviewing the general trend of our results, it would seem that the appearances, stated by anthropologists of all countries to be peculiar to criminals, are thus described because of a too separate inspection and narrow view of the facts by these observers. They cannot see the wood for the trees. Obsessed by preconceived beliefs, small differences of intimate structure have been uncritically accepted by them, and exaggerated to fit fantastic theories

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The truths that have been overlooked are that these deviations, described as significant of criminality, are the inevitable concomitants of inferior stature and defective intelligence: both of which are the differentia of the type of persons who are selected for imprisonment. The thief who is caught thieving, has a smaller head and narrower forehead than the man who arrests him; but this is the case, not because he is more criminal, but because, of the two, he is the more markedly inferior in stature. The incendiary is more emotionally unstable, and more lacking in control, more refractory in conduct, and more dirty in habit, etc., than the thief; and the thief is more distinguished by the above peculiarities than the forger; and all criminals display these qualities to a more marked extent than does the law-abiding public; not because any one of these classes is more criminal than another, but because of their interdifferentiation in general intelligence. On statistical evidence one assertion can be dogmatically made: it is, that the criminal is differentiated by inferior stature, by defective intelligence, and, to some extent, by his anti-social proclivities; but that apart from these broad differences, there are no physical, mental, or moral characteristics peculiar to the inmates of English prisons."

The influence of heredity in the production of crime according to Goring is very strong. Criminality, as most other students of the subject have found, shows a marked tendency to run in families. To the question whether heredity or environmental factors are the most potent in producing criminals, Goring remarks: "We think our figures, showing the comparatively insignificant relation of family and other environmental conditions with crime, and the high and enormously augmented association of feeble-mindedness with conviction for crime, and its well-marked relation with alcoholism, epilepsy, sexual profligacy, ungovernable temper, obstinacy of purpose, and willful anti-social activity—*every one of these, as well as feeble-mindedness, being heritable qualities*—we think that these figures, coupled with those showing the marked degree of ancestral resemblance in regard to the fate of imprisonment, go far to answering this question."

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Whatever the final verdict of criminal anthropology may be concerning the physical peculiarities of the instinctive criminal, the evidence that a large proportion of crime is the outcome of innate mental defects and vicious propensities is abundant and convincing. Nearly all who have personally investigated the subject have found a high degree of criminality, alcoholism, and mental defect in the parents of criminals. Dr. Virgilio finds crime in 26.8 per cent of the parents of criminals, associated frequently with alcoholism. In the parentage of 447 criminals Penta found criminality in 88 cases, hysteria in 55, epilepsy in 33, alcoholism in 135 and insanity in 85. In the parents of 104 criminals whose heredity was examined by Lombroso there were 31 alcoholics, 10 criminals, 10 insane, while criminality and prostitution were prominent in the brothers and sisters. According to Ellis, "of the inmates of the Elmira Reformatory, 499, or 13.7 per cent have been of insane or epileptic heredity. Of 233 prisoners at Auburn, New York, 23.03 per cent were clearly of neurotic (insane, epileptic, etc.) origin, in reality many more." Sichard, in 4,000 German criminals, found a neuropathic inheritance in 36. 8 per cent. And Pauline Tarnowsky in studying 160 women homicides found alcoholism in 71.24 per cent of the parents, mental disease in 10 per cent, and syphilis in 32.5 per cent. Among thieves the percentages of these traits were 49, 6, and 21 respectively, and among prostitutes 82.66, 9, and 48. Among the parents of 50 educated law-abiding women the percentage of alcoholism, mental disease and syphilis was 6, 2, and 10 respectively.

The presence of criminality in successive generations of certain notorious families is doubtless to be attributed only in part to their unfortunate heredity, since environmental factors doubtless contribute largely to the result. One of the first of such families to be studied in detail was the celebrated Jukes family which enlisted the interest of Mr. Dugdale, an able student of social problems and an active worker in prison reform. During his investigations of penal institutions in New York, Dugdale was struck with the recurrence of the same family name among the

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inmates of certain prisons, and he was led thereby to investigate the family connections of these individuals, with the result of discovering a large number of people who were related and who could be traced back to a family of sisters, one of whom, Ada, nicknamed "Margaret, the mother of criminals," gave rise to a progeny who now number over 800 descendants. Pauperism, crime, and especially prostitution were remarkably prevalent among the descendants of this woman. The four other sisters of Ada, whose histories are known, have left progeny whose record is of the same general character. Of the 709 Jukes studied by Dugdale, 180 were paupers or had received poor relief to the extent of 800 years, 60 were habitual thieves, 50 prostitutes, 7 murderers, and the total cost to the state was estimated at $1,308,000.00.

This record was based on the history of the family up to 1875 when Dugdale's report (subsequently, 1887, issued in book form entitled *The Jukes*) was first published. Owing to a chance discovery of Dugdale's original manuscript with the true names of the individuals indicated (the published names were all fictitious) it became possible to trace out the later history of the family. This has been done by Dr. A. E. Estabrook of the Eugenics Record Office, and the results have been published in a monograph, *The Jukes in 1915*. The interval between Dugdale's time and 1915 has seen a rapid increase in the Jukes family with little or no improvement in its general character. Estabrook's investigations covered 2,094 persons of whom 1,258 were living in 1915. Of the whole family up to date considering only those of Jukes blood, 170 were paupers, 129 had received outdoor relief, 118 were criminals, 378 were prostitutes, 86 kept brothels, and 181 were intemperate. The following extract, which is essentially like dozens of others which might be chosen at random from Dr. Estabrook's monograph, will illustrate the general nature of the Jukes family history:

Abe Isaac, by his second consort, Loretta, IV 3, whom he married, had seven children: Avery, Alton, Anson, Augustus, Alma, Alonzo,

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and Amiel. After Loretta died, Abe Isaac cohabited for a short time with Thelma, IV 4, but had no children by her.

Avery, V 3, was "a laborer"; at 30, grand larceny, county jail, 90 days; assault and battery, county jail, 90 days; at 49, rape on his niece, Sing Sing, 5 years; no property. He was none too industrious and received a pension as a Civil War veteran. He cohabited first with Satie, V 2, a wanderer and a harlot, and had two children by her. The older, VI 13, was a harlot like her mother and has been arrested for intemperance and disorderly conduct. The other, VI 14, a son, has disappeared.

Satie deserted Avery and he then married Geneva, V 4, and by her had six children, the first dying at birth. While Avery was in State prison for rape on his niece, Geneva was in and out of the poorhouse with her children, and it was in the poorhouse that, at the age of 31, her bastard child was born. Geneva's family is interesting. Her brother has been in the penitentiary. Her mother was a pauper in the poorhouse at the same time that Geneva and her children were there, making three generations of one family who were being cared for by the town at the same time. There is no doubt that she was feeble-minded. At one time she tried to kill one of her children, and was thereupon sent to a hospital for the insane. She was addicted to the use of laudanum, an overdose of which caused her death.

The first child of Avery and Geneva died in infancy. The second was VI 16, who was 15 when his father was in State prison. At 16 this boy was sent to the penitentiary for petit larceny. At 17 he was a vagrant, wandering here and there. At 18 and again at 20 he was in the poorhouse for one year. At 24 he was sent to the penitentiary for 3 months for petit larceny. At 29 he was sent to State prison for 28 months for assault. At 35 he was in the county jail 1 month for intoxication, and again at 55 he was in the county jail for 10 days for the same offense. He has lost one eye, can neither read nor write, works very seldom, and begs his way wherever he goes. He is mentally defective and should have been in custodial care many years ago. He has cohabited for a long time with a woman, VI 17, who is 10 years older than he, and is a beggar, indescribably filthy, and mentally defective. She has spent most of her life in the poorhouse. At 20 she was there and found her mother and sister there also. She can neither read nor write. She has never had any children.

The third child of Avery and Geneva was a girl, VI 19. She was in

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the almshouse as a young girl and later was placed in a Children's Home. She was discharged from the latter institution after being there but a short time. As a grown woman she was attractive, neat-appearing, and quiet to a casual observer, but she had a career of harlotry begun early in life and continued after she married (at 26) VI 18, an ignorant, semi-industrious, but well-intentioned man. Soon after the birth of her first child, VII 49, she was divorced on the grounds of adultery. Cohabitation with a vicious criminal, VI 20, followed and by him she had two children one of whom died in infancy. This man was convicted of burglary and sent to State prison for 1 to 4 years, and during this time VI 19 again became promiscuous in her sex relations. After his discharge from State prison she again consorted with him, then later left him and cohabited with a negro by whom she had one child. At the age of 39, VI 19 was sent to jail for 10 days for using indecent language. Two weeks after she was discharged she was again arrested with her "husband," VI 20, and with Ulysses, V 194, for the same offense and sent this time to the penitentiary for 3 months. At 40 she was arrested for intoxication and sent to jail for 10 days. Even later in life, to one who did not know the real character of VI 19, her appearance, bearing, and behavior indicated a woman of some refinement. She associated with a woman much like herself in appearance but yet of the same low and vicious traits. She placed two of her children, VII 49 and VII 50, in a Children's Home. Her last child (by a negro) was taken by the negro's people at her death, which occurred at 42.

One noteworthy feature brought out by Estabrook's studies, is the large amount of feeble-mindedness among the Jukes. The children are for the most part retarded in school and give evidence of poor native ability aside from the effects of their home life. The children brought up in institutions generally turned out badly afterward. In general, according to Estabrook, "one-half of the Jukes were, and are feeble-minded, mentally incapable of responding normally to the expectations of society, brought up under faulty environmental conditions which they consider normal, satisfied with the fulfillment of natural passions and desires, and with no ambition or ideals in life."

Feeble-mindedness characterizes the criminal elements of the

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Jukes family even to a much greater degree than the family in general. Estabrook states he was "able to study many of the Jukes criminals of to-day and in every case the individual has been proved without a doubt to be feeble-minded. Willett, who committed murder; VI 529, a low-grade imbecile who committed burglary; Edgar, a rapist; and VI 16, who committed assault, are all mental defectives, and in none of these has their criminal record biased the writer in diagnosing their mentality. There is no evidence in the Jukes which points to the existence of a trait of criminality. Not all feeble-minded Jukes are criminal, but all the Juke criminals that I have known I regard as mentally defective."

Another notorious family with a bad record for criminality is the Tribe of Ishmael whose history has been followed through several generations by the Rev. O. C. McCulloch. The Tribe of Ishmael lived in the central part of Indiana where they made themselves a general nuisance to their neighbors by furnishing a liberal quota of petty thieves, vagrants, paupers, prostitutes, and several criminals of a more desperate kind. Many of these people lived a gypsy sort of life in the summer. A large proportion of the pauperism, prostitution and crime in the region in which this family lived was traceable to this polluted stock. "The individuals already traced are over 5,000 interwoven by descent and marriage. They underrun society like devil grass. Pick up one, and the whole 5,000 would be drawn up. Over 7,000 pages of history are now on file in the Charity Organization Society."

Jörger has traced out the remarkable record of the family Zero which lived in a Swiss valley since the beginning of the 17th century. The family early divided into three branches, two of which consisted of law-abiding citizens. The third branch arose from a man with a taint of insanity who married a vagrant and degraded Italian woman. The son resulting from this union married a woman of a vagabond German family Markus, by whom he had seven children, each of whom formed the starting point of a line of degenerate progeny. For three generations the

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descendants of these lines have been paupers, vagabonds, thieves, drunkards and prostitutes. Mental defect was very common, especially in certain strains, and a considerable amount of syphilis was recorded, and much more probably occurred.

From the standpoint of heredity, such families as the Jukes, Ishmaelites, Zeroes, etc., constitute a complex problem. That bad environment and the evil influences of family traditions are potent factors in determining the degradation of these unfortunate people, there can be no doubt. But there can be little doubt that heredity is a factor of great potency as well. Criminality may be due, not so much to the transmission of vicious propensities (although there is evidence that vicious traits are transmitted), as to the inheritance of mental defect and general lack of stamina.

People with good stuff in them very often rise out of their vicious environment, while others under the best of conditions seem to take instinctively to evil pursuits. We should bear in mind in studying degenerate families and their unfavorable surroundings, that bad environment tends to be created by a bad heredity. Given stocks with an inheritance of low mentality, feeble inhibitions, and more or less mental disorder, in a few generations such stocks would gradually sink into the ranks of dependent or outcast humanity, and would soon develop traditions of vice and immorality which would make it especially hard for an individual to rise in the social scale. When we consider a single individual born amid such unfavorable surroundings, we might be prone to attribute his shortcomings to his poor opportunities. We might be able to point to many cases in which members of degenerate strains have become worthy citizens when given better chances for obtaining success. Such cases, in fact, are not infrequent. But this fact would in no wise controvert the assertion that heredity is primarily responsible for the condition of these degenerate families. Under the conditions that prevail in our civilized society, there is a general tendency for families of good inheritance to rise into higher ranks, whatever misfortunes may have been responsible for their inferior position

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in the social scale. Families of bad inheritance, although they may be endowed with wealth and social standing, tend after a time to sink into lower social strata. The qualities that count in the long run are mental ability, energy and reliability. It is in these traits that the notorious families we have been considering have been so conspicuously lacking. People devoid of these qualities form the ne'er-do-wells, the people who through lack of initiative and energy drift into a bad environment and hence are led into crime.

It is now fairly well established that criminals, or at least those of them who are sent to prison, are, on the average, of subnormal mentality. Here and there, of course, a man of superior ability is convicted of crime. But the men who make up the bulk of our prison population and especially men who have been convicted on two or more occasions (and these constitute the greater part of our prisoners) are distinctly below the general level of intelligence. Dr. Fernald states that "at least 25 per cent. of the inmates of our penal institutions are feeble-minded." According to Dr. Stearns nearly one-fourth of the population of the State Prison at Charlestown, Mass., are mentally defective. Dr. Haines reports that of 100 offenders examined as they entered the Ohio Penitentiary 20 were mentally incompetent. Of the homicides five-sevenths were feeble-minded. The same writer states that of 33 female prisoners of the same institution, 10 were feeble-minded but all the others were of "good mentality." H. B. Donkin states that 20 per cent of the prisoners of England are feeble-minded. The percentage of feeble-minded at Pentonville was found to be 18 per cent for adults and 49 per cent for juveniles.[1]

Recently Dr. Ordahl has made a series of mental tests of 53 male prisoners from the penitentiary at Joliet, Ill., selected in such a way as to secure a fair representation of the prison population.

[1] Dr. Wey of the Elmira Reformatory says, "It is a mistake to suppose that the criminal is naturally bright. If bright it is usually in a narrow line. Like the cunning of the fox his smartness displays itself in furthering his schemes and personal gratification and comfort."

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With the exception of one man of less than 20 years of age, the age of the prisoners lay between 20 and 74, the greatest part being between 20 and 30. In mental age, however, they ranged "from that of a normal child of 6 years, to that of a youth of 15, or what is assumed to be the normal adult intelligence."

Mr. Hastings Hart at a meeting of the American Prison Association in 1913 estimated that 25 per cent. of adult prisoners in state institutions are feeble-minded. Lamb states that 45 per cent of the yearly admissions to the Manhattan State Hospital for the Criminal Insane are imbeciles of various grades, and Moore says that 40–45 per cent of the entrants into the N. J. Reformatory at Rahway during 1910 and the first part of 1911 were subnormal according to the Binet tests. The last report of the Elmira Reformatory places one-third of those received as mentally defective. Similar reports of the low mentality of criminal women tested at Bedford were made by Miss Weidensall who found that the intelligence of these women was considerably inferior to the average intelligence of 300 working girls of 15 years of age.

Recent studies on the mental condition of prostitutes have shown, as might have been anticipated, that a very large percentage of these offenders are mentally defective.[1] Havelock Ellis states that of the "15,000 women who passed through the Magdalen Homes in England, over 2,500, or more than sixteen per cent . . . were feeble-minded." In the *Report of the Mass. Commission for the Investigation of the White Slave Traffic, So-called*, it is stated that "of 300 prostitutes, 154, or 51 per cent, were feeble-minded. . . . The mental defect of these 154 women was so pronounced and evident as to warrant the legal commitment of each one as a feeble-minded person or as a defective

[1] In the last two or three years evidence of the mental inferiority of prostitutes has accumulated with remarkable rapidity. Of recent contributions may be mentioned McCord, C. P., *Jour. Am. Inst. Crim. Law and Criminol.*, 6,388; and *Training School Bull.*, 1915; Ball, J. D., and Thomas, H., *Journal Insanity*, 1918, 647; *Merz*, P. A., *Jour. Am. Med. Assn.*, 1919, 1597; Malzberg, B., *Eugenics Rev.* 12, 100, 1920; Norton, J. K., *Jour. Delinquency*, 5, 63, 1920; Fernald, M. R. *et al.*, *A Study of Women Delinquents in New York State*, N. Y., Century Co., 1920.

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delinquent. . . . The 135 women designated as normal, as a class were of distinctly inferior intelligence." [1]

Dr. Abraham Flexner in his valuable book on *Prostitution in Europe*, says:

Characteristic traits, external and internal, mark the scarlet woman; she has a distinct gait, smile, leer; she is lazy, unveracious, pleasure-loving, easily led, fond of liquor, heedless of the future, and usually devoid of moral sense. Defect undoubtedly accounts for certain cases, and especially so where a psychopathic family strain is continuously implicated. Of 21 girls recently admitted into a newly-established observation home in Berlin, 5 were reported as mentally below par; of Mrs. Booth's 150 cases discussed below, 12 per cent were feeble-minded. In the case of prostitutes committed under the British Inebriate Acts, the percentage naturally runs much higher: in 1909, out of 219 such immoral women, only 70 are described as of "good" mental state; 118 were "defective"; 23, "very defective"; 8, "insane"; *i. e.*, almost 70 per cent were below normal. . . . Bonhöffer, studying 190 prostitutes incarcerated in prison at Breslau, found that one hundred came from alcoholic families and that two-thirds of them were mentally defective—hysterical, epileptic or feeble-minded; his judgment is adverse to the existence of the born prostitute, but in favor of congenital defect as providing soil favorable to immorality.[2]

The association of crime and delinquency with mental defect which has been found among adult offenders, has been made strikingly apparent in recent studies of the mental status of juvenile delinquents. Kelly reports that the boys of the Gatesville Industrial School to which boys are committed as a rule only

[1] According to Dr. Davis of the Bedford Reformatory for Women out of 647 cases in the Reformatory there were 20 of insanity, 107 of feeble-mindedness and 193 of mental defectiveness according to the Binet tests. The Portland Vice Commission reported that out of the 2,500 prostitutes of Portland, 25–50 per cent were mentally defective.

[2] In his monumental work, *De la prostitution dans la ville de Paris*, Parent-Duchatelet remarks: "Un des faits qui m'ont frappé en faisant mes recherches dans le *Bureau des Mœurs* et dans les archives de la Préfecture de Police, c'est la fréquence des observations sur la *faiblesse de tête* et sur l'état voisin de l'aliénation mentale attribue aux prostituées."

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after they have been guilty of more than one offense, show, when tested by the Binet and several other tests, a marked inferiority in mental development. The proportion of feeble-minded was 20 per cent, "but probably at least 50 per cent of delinquents are totally incapable of being taught to look after themselves in an environment as unfavorable as the one from which they came." The results of Ordahl's investigation of the cases brought before the Juvenile Court of San José, California, reveal the fact that "25 per cent of the criminal dependents, 45 per cent of the minor delinquents, and 75 per cent of the adult delinquents are feeble-minded. If the feeble-minded and borderline group are combined, then 45 per cent of the minor dependents and 60 per cent of the minor delinquents are below average-normal intelligence. In both the minor dependent and the minor delinquent group 60 per cent of the parents, so far as data were available, are either alcoholic, immoral, feeble-minded or insane."

Ordahl's study of 341 delinquent boys of a school at St. Charles, Ill., to which boys are committed for various offenses, reveals the existence of nineteen and six-tenths per cent of distinctly feeble-minded cases; 20.8 per cent were of very dull mentality "and many of these would probably prove on further study to be feeble-minded"; 15.5 per cent were borderline cases, the remaining 44.1 per cent. being of normal mentality. J. H. Williams finds that out of 215 boys in the Whittier State School the distribution of intelligence was as follows:

Feeble-minded	32 per cent.
Borderline	21 " "
Dull Normal	27 " "
Normal and Superior	20 " "

Dr. Haines' reports on the intelligence tests of 671 boys from the Ohio Boys Industrial Home, and 329 girls of the Ohio Girls Industrial Home, reveal much the same condition. All the inmates were tested by both the Binet-Simon and the Yerkes-Bridges Point Scale tests. The proportion graded as feeble-

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minded according to the latter was 29 per cent and according to the former 57 per cent. Hauck and Sisson's studies of 201 boys and girls of the Idaho Industrial Training School show 24.6 per cent of feeble-mindedness among the boys, and 35.3 per cent of feeble-mindedness among the girls. In their study of young repeated offenders Drs. Spaulding and Healy found epilepsy or mental deficiency in 245 out of 668 cases in which a thorough study could be made; 152 cases showed moral defect in a preceding generation often combined with a psychopathic or neuropathic inheritance. Of the transmission of criminal traits as such the authors could find little evidence. An individual study of fifteen cases in which a peculiarly criminal inheritance was suggested convinced the authors that "various physical or mental factors are the real inheritance, and that criminalism may be implanted on these in successive generations." All told, the indirect influence of heredity on criminalism appears to be that in 35 per cent there is predominantly a transmission of mental or physical defect, and that in 9 per cent such inheritance is partly responsible. This makes a total of 44 per cent in which bad heredity is indirectly responsible for crime.

The percentage of mental defect reported among juvenile malefactors naturally varies greatly in different groups, according to the basis upon which they are selected, and the kinds of tests applied. Travis, in his book on *The Young Malefactor* attributes the chief causes for juvenile delinquency to unfortunate environmental influences. While recognizing the importance of bad heredity, Travis opposes the views of the Italian positive school in claiming that "there are no stigmata of either crime or types of crime, but only of abnormality or degeneration. . . . A study of the delinquent with respect to his physical, mental and ethical conditions, shows that at least 90 per cent and probably 98 per cent of first court offenders are normal."

With due appreciation of the value of Travis' studies of the various factors which contribute to juvenile delinquency, and without opposing his contention that these offenders fail to show the physical stigmata of the so-called "born criminal," I am by

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no means convinced from the evidence presented that the delinquents are as nearly normal in their mental development as the author contends. I fail to find in his volume any record of the application of mental tests, and in fact there is very little discussion of the rôle of mental retardation in juvenile crime. This omission is probably due to the fact that the application of mental tests has been carried on for only a few years. Under the circumstances, and in view of the contrary findings of other investigators, little reliance can be placed on the estimate just cited.

The number of boys and girls who get into trouble through bad home conditions, evil associates, loss of one or both parents, and various other unfavorable influences is doubtless large, as most students of the subject have shown. While many a boy or girl of good natural mental or moral qualities has been led into criminal ways, nevertheless a considerable proportion of the conditions which predispose children to delinquency are indirectly the result of bad heredity. Intemperance, vice, pauperism, separation of parents, lack of parental control, ignorance, and many other factors to which juvenile delinquency is so often attributed, are very frequently the result of inherent incapacity or defect. Environment, as in so many other cases, gets the credit for what in the long run should be laid to the door of heredity.

It is probable that an investigation of the men who constitute our tramps and vagrants would demonstrate a degree of mentality much like that in the inmates of prisons. According to Dr. C. H. Parker, "the Department of Education of Stanford University tested two hundred unemployed of the migratory labor class, and almost an even 25 per cent were found to be feeble-minded. Binet tests made in 1913 by the Economic Department of Reed College, Portland, covering 107 cases taken from the unemployed army showed the percentage of feeble-mindedness to be 26."

Bonhoeffer has made a study of 404 individuals as they were committed to the central prison of Breslau, Germany, for begging or vagrancy. The investigation was confined to individuals who had served repeated sentences before their prison confinement, the number varying from 6 to over 60. These social parasites and

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outcasts, as might have been anticipated, were found to be highly abnormal; 22 per cent were adjudged feeble-minded and 11 per cent were epileptic. Those of dull mentality were more numerous. As a rule their schooling was very limited. Many did not know the name of the Kaiser. Several who were born in Breslau could not tell the name of the river upon which that city is situated; others confused the Pope with the cardinal residing in Breslau, and for several, Prussia, Germany and Europe were synonymous terms. Some also were ignorant of the main points of the compass, the number of months and weeks in a year, and the name of Bismarck. However poor his educational advantages may have been, it seems improbable that a person of normally active mind could have grown to maturity and remained ignorant of such matters as these.

Only a small percentage were not addicted to alcohol, the favorite form being brandy. The relatively small proportion that came from the upper classes almost without exception were mentally unbalanced and came from insane (9 per cent), epileptic (12 per cent), or alcoholic (79 per cent) parentage. While the general morbidity of the group was high, few were physically unfit for labor. The majority, however, had been rejected as army recruits. Most of them had been from time to time unskilled laborers of various kinds, and a great many originally came from the country.

What was ascertained of the inheritance of these men indicated that a bad heredity was primarily responsible for much of their misfortunes. In a half of the cases there was a direct alcoholic psychopathic inheritance from either the father or mother. Doubtless more parental defect would have been discovered had it been possible to secure reliable data.

The pedigrees of paupers, so far as they have been studied, show a large percentage of mental defect. The Eugenics Education Society in 1910 appointed a committee to investigate the families receiving poor relief. The investigation dealt not only with those who were poor through accident or misfortune, but with those families whose members showed a chronic disinclina-

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tion for honest work. Pauper families were found to marry into other pauper families, some families even producing paupers through several generations. The committee reported that many of "the paupers whom they had seen and examined individually, are characterized by some obvious vice or defect such as drunkenness, theft, persistent laziness, a tubercular tendency, mental deficiency, deliberate moral obliquity, or general weakness of character, manifested by the want of initiative, energy or stamina." In his discussion of the findings of this committee, Whetham cites two families which are described as average specimens of the results obtained: "Out of a family of twelve children, of whom four were dead, two were in industrial schools and one was in the workhouse. Both parents were paupers, all four grandparents, and, in addition, three uncles, one aunt, one aunt by marriage, three great-uncles and one of their wives, two great-aunts were kept at the public expense. Another branch of the same family gave the following results: An imbecile child was found in the wards of a workhouse infirmary; its paternal grandfather's brother was a lunatic, the mother's father was an insane epileptic, her mother was consumptive, her maternal grandmother was probably consumptive and certainly a pauper, while the mother herself was illigitimate and subject to fits."

The history of the Jukes, the Tribe of Ishmael, the Hill Folk, the Nams, and several other families show that much pauperism is a sort of family tradition resting upon a fundamental basis of inherited defect. The bad environment among which children of such families are usually raised makes paupers, vagrants or criminals of many who otherwise might have led useful lives.

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CHAPTER V

THE INHERITANCE OF MENTAL ABILITY

"We inherit our parents' tempers, our parents' conscientiousness, shyness, and ability, as we inherit their stature, forearm, and span."—Karl Pearson.

We have seen that feeble-mindedness and other forms of mental defect tend to be strongly transmitted. Can it be shown that the same statement applies to superior ability? For various reasons the doctrine that mental traits are inherited has been regarded with suspicion, and has frequently encountered active opposition. Many writers, influenced by a theological or metaphysical bias, have been reluctant to admit that the laws of heredity which apply to the transmission of physical traits hold also for the mind. Many political and social theorists have found it convenient to minimize the importance of the innate mental differences between men, and have attempted to explain such mental differences as were only too obvious as the result of accidents of education, early experience, and other circumstances external to the individual himself. The doctrine of the equality of man preached by Rousseau and his followers and embodied in our own Declaration of Independence had a tendency to prevent due recognition of the fact that human beings differ profoundly in their inherited mental gifts. The admission of such inheritance might prove a dangerous concession to the claims of aristocracy, and it is not surprising, therefore, to find such a champion of popular rights as Thomas Paine contending against the possibility of the inheritance of mental ability. Writers of a much later period, though inspired by much the same motives, have expressed similar views. Henry George, who, like many other socialists, attempted to explain the differences among men as chiefly the production of an iniquitous social order, stated that

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"The influence of heredity, which it is now the fashion to rate so highly, is as nothing compared with the influences which mold the man after he comes into the world."

The establishment of the theory of evolution, and its application to the development of mankind could scarcely fail to direct renewed attention to the inheritance of mental qualities in man. Inspired by this doctrine and stimulated by the writings and personal influence of his cousin, Charles Darwin, Francis Galton was led to undertake those studies on inheritance by which he has since become famous. The investigations which Galton made upon the inheritance of ability were embodied in his celebrated volume on *Hereditary Genius*. In this work Galton showed that superior ability runs in certain families to a very marked degree. We are all familiar with families which are celebrated for the number of their great names: In science, the Herschels, Bernouillis, De Candolles, Darwins and Gregorys; in literature, the Brontës, the Arnolds, the Hallams, and the Lowells; in music, the Bachs and the Mendelssohns. It might be contended that the occurrence of such groups is purely fortuitous. Even if there were no transmission of ability or any other reason why persons of the same family should become distinguished it would be possible, from all the great men in the world, to pick out a considerable number of cases in which two or more men of great ability happened to belong to the same family. Galton, who was too critical an investigator to base his case merely on evidence especially selected to prove his theory, undertook an impartial statistical inquiry into the families of eminent men in order to ascertain how far the data obtained would yield evidence of the hereditary basis of great ability. Eminent men were classified into several groups, judges, scientists, literary men, statesmen, poets, musicians, painters and divines. The basis for selection varied with the different groups, but was in all cases made so as to include the most eminent persons regardless of heredity. Then the endeavor was made to determine to what degree eminent men in these groups had eminent relatives. It was shown that eminent men have eminent relatives to an enormously greater degree than do

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ordinary people, and that, as a rule, the more eminent the person, the more eminent persons are to be found among his near relatives. Thus 80 per cent of the Lord Chancellors had eminent relatives, whereas only 36 per cent of the other judges were thus distinguished. Similarly it was shown that in the families of the more illustrious statesmen there is a larger percentage of great names than in the families of statesmen who are less eminent. In general, the proportion of eminent relatives of great men is found to decrease as the relationship becomes remote.

It is impossible in a short space to give an adequate summary of the large amount of interesting data which Galton amassed, and especially of the able discussion of the thesis that the facts are explicable only by the hypothesis that great ability is transmitted in much the same way as are most characteristics of organic beings in general. It has never been questioned that Galton's investigations have demonstrated the tendency of certain stocks to produce men of distinguished ability. But Galton's critics have maintained that this tendency is based, not upon heredity, but upon the peculiar advantages which these families offered for the development of whatever talent they may have possessed. A parent-offspring or a fraternal correlation does not in itself prove inheritance. The degree of education attained by the members of a family, for instance, may depend upon wealth, family tradition, or a number of other circumstances quite apart from heredity. A child born in the slums, even with the best inheritance, suffers certain very obvious disadvantages as compared with a child of a Lord Chancellor. Mr. Constable in his *Poverty and Hereditary Genius* which is devoted to controverting Galton's conclusions, has urged that for many people the drawbacks of poverty are so great as to prevent them from ever gaining a reputation for distinguished achievement. There is, he claims, a large amount of latent ability in the general population that awaits only the touch of opportunity to blossom forth. Similar views are held by many other writers, among the most noteworthy of whom is the Nestor of American sociologists, Dr. Lester F. Ward.

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Galton, however, did not fail to ascribe a certain degree of importance to environment in the making of great men, but it is probable that he unduly minimized its influence. The number of distinguished men per century has rapidly increased as civilization has advanced and as education has become more widely diffused, but we cannot maintain that there has been a commensurate increase in the amount of inherited ability in the race. Great men appear more abundantly near centres of learning than in regions less subject to the intellectual leaven of culture. It is true that many men born in poverty have attained greatness only after a long struggle that seemed to develop their intellectual powers and force of character. But there is no way of ascertaining how many others there have been who might have achieved greatness had they received the proper stimulus for developing their latent power, or who may have become discouraged in their strivings by the deadening influence of a life of toil.

Among people who are financially able to give their children the advantages of a good school and college education, the environmental conditions that tend to give rise to greatness in a country like England are not apparently very unequal. Children in families with intellectual tastes may have a somewhat better chance to become distinguished than if they had a less stimulating home environment. It cannot be assumed, however, that the home of a great man usually affords a much better nursery for genius than many another home among people of intelligence and culture. So far as environment is concerned it is probable that the family of an English judge of the Court of Chancery might be as favorable for the production of an eminent person as the family of a Lord Chancellor. We might admit that Galton underestimated environmental influence, but his critics have never shown, with any degree of plausibility, that environment accounts for the striking tendency of eminent people to have eminent near relatives.

Valuable contributions to the subject on the inheritance of ability were later made by Galton in his work on *English Men of Science*, and especially in his volume on *Noteworthy Families*

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written in collaboration with Edgar Schuster, the first Galton Research Fellow in Eugenics in the University of London. Material for the *Noteworthy Families* was obtained from answers to circulars sent to all of the Fellows of the Royal Society whose names appeared in the Year Book for 1904. Replies were received from 207 of the 467 addressed, and as over half of these were incomplete in regard to several members of the family, the inquiry was limited to 100 of the most complete records.

Probably a better selection could not be made for the purpose of studying the inheritance of ability. The Fellows of the Royal Society are very carefully chosen by the Council of that society on the basis solely of distinguished achievement. Political influence, financial status, or the many other aids which sometimes place men of mediocre talents in positions of prominence have practically no weight in the choice of a man for the honor of a F. R. S. An inspection of the list of families with their imposing array of great names can scarcely fail to convince any one that they represent an aristocracy of ability of the most noteworthy kind. The first family on the list, the Balfours, includes:

(1) Arthur Balfour, Prime Minister, 1902, President of the British Association, 1904, noted statesman and author.
(2) Francis M. Balfour, F. R. S., his brother, Professor of Animal Morphology at Cambridge, brilliant investigator in Embryology, and generally regarded as one of the most able and promising of English biologists at the time of his early death.
(3) The Right Hon. Gerald W. Balfour, P. C., Fellow of Trinity College, Cambridge, and president of the Board of Trade, in 1902.
(4) Eleanor M. Balfour (Mrs. Henry Sidgwick), Principal of Newnham College, Cambridge.
(5) Evelyn, wife of Lord Rayleigh, F. R. S., and mother of Robert J. Strutt F. R. S.
(6) The Marquis of Salisbury, K. G., P. C., F. R. S., Prime Minister, Chancellor of the University of Oxford, president of the British Association, statesman and essayist.

Surely environment does not explain the distinction of a family like this, or of many others in Galton's list. The appendix of the

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work contains a list of 32 noteworthy fathers of 38 Fellows of the Royal Society.

One of the most striking illustrations of the inheritance of ability is afforded by the descendants of Erasmus Darwin. On the originality, general ability, and productiveness of Erasmus Darwin it is not necessary to comment. Robert Waring Darwin, his son, was a distinguished physician, and, like his father, a F. R. S. Another son, Charles, was a man of remarkable promise, and although he died at the age of 20, he gained the first gold medal of the Æsculapian Society for experimental research. Charles Robert Darwin, the author of the *Origin of Species*, and by common consent one of the world's greatest men of science, was the son of Robert W. Darwin. He married his cousin, Emma Wedgewood, a granddaughter of Josiah Wedgewood, F. R. S., the founder of the pottery works that produced the famous Wedgewood ware. Charles Darwin's four sons became men of note: Francis Darwin, F. R. S., a prominent English botanist; George Darwin, F. R. S., noted astronomer, and Professor of Astronomy at Cambridge; Horace Darwin, F. R. S., a prominent engineer; Major Leonard Darwin, author of works on political economy, president of the Eugenics Education Society, and president of the International Eugenics Congress. Finally must be mentioned Francis Galton, cousin of Charles Darwin, grandson of Erasmus Darwin, and an excellent illustration of the hereditary genius, the potency of which he did so much to demonstrate.

The inheritance of mental and moral traits has been studied by Pearson and some of his colleagues by statistical methods similar to those employed in the study of the inheritance of physical traits. An intensive investigation was carried out by Pearson upon from three to four thousand school children. Instead of attempting to compare the mentality of parents and offspring, Pearson studied the resemblance in mental and moral traits of offspring of the same parents. The data upon which the comparisons were based were obtained from the teachers whose judgment of the mental and moral status of their pupils may be

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considered, on the whole, to have a fair amount of accuracy. Various physical measurements of the children were also taken, so that it was possible to compare the resemblance of the children in mental characteristics with their resemblance in physical characters. The correlations between brother and brother, sister and sister, and sister and brother for various physical characteristics averaged about .5. The fraternal correlations in mental and moral characteristics are expressed in the following table:

Resemblance of Siblings in Mental Traits

	Brothers	*Sisters*	*Brothers and Sisters*
Veracity	.47	.43	.49
Assertiveness	.53	.44	.52
Introspection	.59	.47	.63
Popularity	.50	.57	.49
Conscientiousness	.59	.64	.63
Temper	.51	.49	.51
Ability	.40	.47	.44
Handwriting	.53	.56	.48
Mean	.52	.51	.52

It is certainly remarkable that siblings should not only resemble one another in several mental and moral traits to so nearly the same degree, but that the degree of resemblance should be just about the same for both mental and physical traits. If the fraternal correlation for mental ability or temper is about the same as the fraternal correlation for eye color and cephalic index (characters not sensibly influenced by the environment) we must conclude, as Pearson argues, that correlations in these mental characteristics are due mainly to inheritance. Of course association, similarity of home environment, and common training may tend to increase these correlations. If a favorable home environ-

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ment is correlated with superior performance of the student, it does not follow that the former may not be the result of superior heredity on the part of the parents. As Pearson remarks: "The average home environment, the average parental influence is in itself a part of the stock and not an external and additional factor emphasizing the resemblance between children of the same home." Doubtless this consideration which is not sufficiently appreciated by those who would make environmental differences all important, is of much weight. We are still lacking, however, an adequate measure of the extent to which similarity of conditions may produce similarities in mental characteristics. The most reasonable position in the face of such evidence as we have just considered is that as regards the traits in question, differences in heredity are much more important than differences in environment. No other position seems to be easily reconciled with the remarkable similarity in the degree of resemblance between correlations for physical and mental characteristics.

How often do we find among children of the same family exposed to very similar conditions and having practically the same training, but manifesting the greatest differences in tastes, temperament, vivacity, ability, and other mental traits! Nor is it a matter of common experience that these differences become notably lessened with longer association and subjection to the same environmental influences. The measurements of Thorndike on the performance of school children who have been associated for several years in the school, showed that the children were quite as much unlike at 12 to 14 as between 9 and 10. Students differing in their ability to perform certain tasks such as addition were given precisely the same training, and then tested again at a later period. Those who performed the task best at the beginning of the experiment performed the task best at the end, and they stood relatively further ahead of the poorer ones than at first. Equalizing opportunity does not tend to make people equal. If the opportunities for development are good those with the best inheritance will profit so much more than those with poor inheritance that the original differences between

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them will be considerably increased. As we have before remarked, what environment can do for a person depends upon how generously he has been endowed by inheritance. Of individuals who inherit well it may in truth be said: "To those that hath shall be given." If one's inheritance is poor there is nothing which this world can offer that will compensate for the loss.

Schuster and Elderton have studied the inheritance of ability by means of biometric methods similar to those employed by Pearson. In one investigation these authors worked out the parent-offspring correlations from data obtained by Heymans and Wiersma in their studies of psychical inheritance. These data were secured by sending out 3,000 questions to Dutch physicians. Each questionnaire contained ninety questions covering quite completely the psychical characteristics and peculiarities of the subjects described. Over 400 replies were received, which is a fairly good return considering the detailed information sought for in the questionnaires. The degree of correlation between parent and offspring was found to vary considerably for different traits, but, after correcting for the influence of assortative mating, the average correlations were found to be as follows: father and son, .279; father and daughter, .252; mother and son, .194; mother and daughter, .305. Considering the way in which the data were collected and the adventitious source of heterogeneity in the material the correlations show a noteworthy degree of similarity to those discovered by Pearson.

In another study by Schuster and Elderton the material used was derived from scholars at Oxford and the boys' schools at Harrow and Charterhouse. From the Oxford records a comparison was made between the scholastic standings of fathers and sons who had attended the University. Since 1800 the University of Oxford had four classes of honors, those graduating without honors receiving simply the "pass" degree. Those who attended the University, but who failed for one or another reason to graduate constituted a class whose scholastic standing is on the average lower than those who graduated without honors. Obtaining honors can legitimately be held to offer a fair index of

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ability. It is quite well established that high standing in college is correlated with success in later life. Should it be found, therefore, that sons in the honor class have a relatively large proportion of fathers in the high honor class, while sons of the "pass" or ungraduated classes have a relatively large proportion of fathers in these classes also, it would offer strong evidence of hereditary differences in ability. The results of the study may be summarized in the following table:

Scholarship of Fathers and Sons at Oxford

Sons Obtaining	*Percentage of Fathers Obtaining First or Second Class Honors*
First class honors	41.9
Second class honors	40.7
Third class honors	33.3
Fourth class honors	28.1
Pass degree	20.1
No degree	12.9

The striking feature of this table is the regularity with which the percentage of high scholarship among the fathers decreases as the scholarship becomes lower in the sons. The correlation coefficients between father and son were .29 or .31 according to which of two methods of calculating the coefficients was employed. The correlation coefficient of brother and brother was somewhat higher, viz., .405, due possibly to the fact that methods of instruction, standards of grading and other circumstances were more nearly alike for brothers than for fathers.

The scholastic records of two secondary schools, Harrow and Charterhouse, were investigated by much the same methods, but owing to the absence of data concerning the parents the study was limited to comparisons between brothers. The data which were drawn from several thousand students gave a fraternal correlation of .398 which is very close to what was found for the students at Oxford. This correlation did not increase sensibly with increasing age of the students.

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The inheritance of arithmetical ability has been studied by Cobb who applied the "Courtis Tests in Arithmetic Series A" to the parents and children in eight families of the faculty of the University of Illinois. The records were compared with norms obtained by testing 200 students of the same institution of much the same degree of maturity and social status. Cobb studied particularly the relation between the aptitude for addition, subtraction, multiplication, division and copying figures in both parents and children. One individual may be good in addition and poor in division, and the endeavor was made to find if the relative of that individual would show the same distribution of aptitudes. The results of the study yielded considerable indication of alternative inheritance of the traits in question. The average correlation with the mid parent was .49, with the like parent .60, with the unlike parent .01. The numbers of individuals dealt with were too small to yield results which would be convincing by themselves, but they serve to corroborate the general conclusions of other investigatiors. The studies of Starch on the resemblance in the performance of scholars from the same family yield further confirmatory evidence.

Next to Galton's *Hereditary Genius* perhaps the best known investigation of the inheritance of mental traits is the work of Woods on *Mental and Moral Heredity in Royalty*. Members of royal families offer some peculiar advantages for such a study since their genealogies are matters of record to a greater extent than those of ordinary people; as a class they are free from the struggle for livelihood and have usually enjoyed educational advantages of a superior kind. Differences in environment probably affect the intellectual development of royalty much less than that of the majority of mankind.

The study of Woods embraced all members of the royal families of Europe about whom information could be secured. Individuals were grouped according to their intellectual ability into ten catagories, number 1 including those generally adjudged to be imbeciles, number 10 including only a few of the most illustrious names, while the great majority naturally fell into the intervening

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classes. A similar rating was made of moral qualities. The rating of the intellectual status of royalty,—a very difficult matter,—was made on as impartial a basis as possible. Grades 9 and 10 included only names occurring in *Lippincott's Dictionary of Biography* and especially celebrated also on account of high intellectual power. Judgments of biographers and historians were relied upon for determining the various grades. Many errors of rating were doubtless made, as Woods himself admits, but it is not probable that many of the lowest classes were put into the highest classes, or vice versa. Probably most individuals in the middle grades belong somewhere near the grade in which they were placed. In a statistical investigation of this sort if most of the judgments are approximately correct the conclusions drawn will be of value.

While much evidence was given of the alternative inheritance of mental traits, it was shown that rulers of great ability manifested a strong tendency to cluster in groups. Such families as the Montmorencys, Condés, and the Houses of Nassau-Orange and Hohenzollern and the descendants of Gustavus Vasa of Sweden present a marked contrast to the House of Hanover and several other dynasties.

The parent-offspring correlation based on 494 pairs was .3007 for mental and .2983 for moral qualities. Offspring and their grandparents gave a correlation of .161 for mental and .175 for moral qualities. The results obtained by Woods are in striking agreement with those of Pearson, Schuster and Elderton and other investigators, the agreement being all the more noteworthy since the material investigated differs so much from that of other studies.

A short paper by Woods on *Heredity and the Hall of Fame* offers additional evidence of transmitted ability; 26 out of 46 men in the Hall of Fame had close eminent relatives. "If all the eminent relatives of those in the Hall of Fame are counted, they average more than one apiece. Therefore, they are from 500 to 1,000 times as much related to distinguished people as the ordinary mortal is."

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While it is recognized by nearly all competent students that mental ability is inherited, the precise method of its inheritance is not thoroughly established. Heritable characteristics present very different amounts of purely somatic or fluctuating variability and it would seem not improbable *a priori* that superior mental endowments depending, as they do, upon the delicate and intricate organization of the brain may be subject to such variability to an unusual degree. A child of good ancestry but exposed while *in utero* to the influence of malnutrition, alcohol, or the toxins of disease at the time when the delicate architecture of its brain is being built up may fall considerably short of its normal expectation in intellectual development. But notwithstanding its intricate structure and the apparent ease with which the delicate balance of its organization might be upset, the nervous system is reproduced in successive generations with a remarkable degree of fidelity, both as regards its external connections and its internal mechanism. Possibly the fluctuating variations in the nervous system may be in part responsible for the fact that the parent-offspring and fraternal correlations in the inheritance of mental traits are usually found to be somewhat below those observed for various physical characters. But there are other reasons which might plausibly be assigned also. Although fluctuating variability may affect the basis of mentality somewhat more than it affects eye color or cephalic index it is not sufficient greatly to obscure the facts of mental inheritance, or to reduce very markedly the coefficients of mental resemblance between near relatives.

Is the inheritance of mental traits in accordance with Mendel's law? The question is one of peculiar difficulty since mental traits, as a rule, do not present the sharply definable and discrete features that often characterize the physical peculiarities of the body. Common observation, however, yields abundant evidence of the alternative inheritance of mental characteristics. Almost every family includes children with different aptitudes, dispositions, and tastes that manifest themselves from early infancy. In their mental characteristics children resemble now the father, now the mother or some grandparent or other relative. Many

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readers will recall in this connection the much quoted lines of Goethe:

"Vom Vater hab'ich die Statur,
Des Lebens ernstes Führen:
Vom Mütterchen die Frohnatur
Und Lust zu fabuliren.

Urahnherr war der Schönsten hold,
Das spukt so hin und wieder.
Urahnfrau liebte Schmuck und Gold,
Das zuckt wohl durch die Glieder.

Sind nun die Elemente nicht
An dem Complex zu trennen;
Was ist denn an dem ganzen Wicht
Original zu nennen?"

A number of investigators have come to the conclusion that superior intellectual ability as well as a number of special talents are transmitted as recessive characters. Hurst considers musical ability recessive, and Davenport from a study of numerous family records draws the same conclusion in regard to artistic ability, literary ability, mechanical skill, calculating ability and memory, all of which are held to be "unit characters that may occur in any combination."

A careful consideration of the evidence adduced by Hurst and Davenport fails to convince me that the traits mentioned are recessive, and I am very decidedly of the opinion that they cannot be considered as unit characters in the usual sense of this term. It is not denied that Mendel's law holds for the transmission of mental as well as physical characteristics, but it is not proven that mental peculiarities are inherited in accordance with any simple Mendelian ratio. Neither is the evidence satisfactory that superior ability of various kinds is recessive to the normal condition. Such a conclusion is improbable *a priori* from what we know of the transmission of mental defect. If feeble-

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mindedness of various grades is recessive or partly recessive to normal mentality, and if the lower grades of feeble-mindedness tend to be recessive to the higher forms, we should expect to find average ability recessive to superior ability. It is not an easy matter, especially when dealing with incomplete records and with characters which (like musical and artistic ability) are strongly influenced by family traditions, to determine whether a given character is dominant or recessive. The test of recessiveness is given if the matings of parents both of whom have the character in question produce children all of whom inherit this character. But this test is never completely satisfied, although non-conforming cases might conceivably be explained.

We should get much the same results if the character were dominant and several determiners were concerned in its production as in the case of the dark color of various kinds of wheat and oats. On the whole, I believe the inheritance of exceptional ability is best explained—though I cannot here give in detail the evidence for this conclusion—on the assumption that it depends upon many factors which behave as dominants to those which give rise to ability of an inferior kind. The fact that parents of superior ability produce, though only occasionally, offspring which, although normal and healthy, never come near to measuring up to the intellectual capacity of their parents, is quite in accord with this view, while opposed to the theory of the recessive nature of superior mental endowments. Results of negro-white crosses yield confirmatory evidence of the same view.

Perhaps the doctrine that genius or great ability is a sort of anomaly dependent upon some defect of the germ plasm has been fostered by the rather prevalent notion that genius tends to be associated with insanity. The doctrine expressed by Dryden in the lines;

> "Great wits are sure to madness near allied,
> And thin partitions do their bounds divide,"

not only expressed a popular conviction, but the sober conclusion of many scientific men who have devoted especial attention to the

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problem. So eminent an authority on insanity as Dr. Henry Maudsley has stated, "It is no exaggeration to say that there is hardly ever a man of genius who has not insanity or nervous disorder of some form in his family." Moreau de Tours who did much to bring the relation between genius and insanity into prominence regarded genius as a "neurosis, or abnormal exaltation of the intellectual faculties." Lombroso, who has written most copiously on this topic, finds that men of genius commonly exhibit neuropathic traits indicative of a degenerate taint, and have many peculiarities in common with the actually insane. The foibles, eccentricities and weaknesses of men of genius have afforded a theme for almost endless comment. And it is not to be wondered at that those who contend that genius represents a sort of pathological variation have no difficulty in collecting a number of instances which fit their case. But a doctrine based on evidence especially selected to prove the thesis rests upon a very inadequate basis. What most of the writers who have accepted this doctrine have done is simply to collect all the cases that they could find in which men of eminence became insane or exhibited occasional eccentricities. However extensive and imposing such a collection of facts may be, it really proves nothing if one excludes, as is usually done, the very numerous cases which do not bear out the theory.

The obviously scientific method of attacking the problem would be to ascertain the percentage of insanity in a rather large random sample of people of superior ability, and to compare it with the percentage of insanity in the general population of corresponding limits of age. The only writer with whom I am acquainted who has ever attacked the subject by an impartial statistical method is Havelock Ellis in his *Studies of British Genius*. Selecting, according to certain rules, 1,030 names from the *Dictionary of National Biography*, he found that, even when slight or dubious cases were included, the percentage of men and women who became insane was not more than 4.2 per cent. A study of the parents of these British men of genius showed, contrary to Maudsley's statement, that insanity could not be

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traced in more than 1 per cent of the cases. "No doubt," says Ellis, "this result is below the truth, . . . the insanity of the parents must sometimes have escaped the biographer's notice. But even if we double the percentage to escape this source of error, the proportion still remains insignificant."

A few years ago without being aware of the existence of Ellis' work, I suggested to one of my students, Mr. C. A. James, that he ascertain the percentage of insanity in chosen lists of great men. Taking the men from Galton's *Hereditary Genius* and a few shorter lists, it was found that pronounced cases of insanity occurred in less than 2 per cent. Cases of slight neuropathic disorders were not included because it was the aim to employ much the same standards for judging people insane as are employed in collecting statistics of insanity in the general population. Over one-fifth per cent of the population in the United States are in hospitals for the insane according to the census for 1910. About one-third of this number is discharged every year, many of whom soon find their way back again, and since many others are cared for outside of hospitals, we may estimate conservatively in the light of statistics from other countries that at any given time one-third per-cent to one-half per cent of the population is actually insane to a degree that would warrant custodial care. When we limit our enquiry to the percentage of insane cases among people within the age limits in which a reputation may be gained for intellectual eminence, the percentage of insanity would naturally become several times greater. Then, if we further consider the number within these age limits who will develop insanity sometime during their lives we will obtain a much larger ratio still, but one which may be compared with the ratio of insanity found to occur among those who have become noted for their intellectual ability. What data we have on the subject indicates that insanity is rather less frequent among the intellectuals than the people at large. Certainly there is a much higher correlation between insanity and feeble-mindedness than there is between insanity and genius, unless we define genius in such a way as to include only those great men who are one-sided or

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eccentric. If we did so we should have to exclude from the ranks of genius such men as Shakespeare, Goethe, Aristotle, Darwin and many others who occupy the very highest rank among the great men of the world. It is possible to find little eccentricities or idiosyncracies in such normal men as these, but a similar scrutiny of the life of almost anyone would reveal the same thing. One of the conclusions arrived at by Galton in his study of eminent men of science was that these men constituted a group distinguished for physical and mental health.

One of the circumstances most commented upon in discussion of the inheritance of great men is the fact that the parents of many men of genius never exhibited any evidence of superiority which would lead one to suspect that they would give rise to a person of exceptional eminence. And we are reminded of Newton, Lincoln, Goethe, Shakespeare and others who appear to rise like great isolated mountain peaks out of the level plain of ordinary humanity. Sometimes it is suggested that such men are comparable to the "sports" or mutations that appear from time to time in plants and animals.

It should be borne in mind that greatness involves a peculiar complex of qualities the lack of any one of which may prevent an individual from achieving an eminent position. A great man has to do more than simply exist; he must accomplish labors of a particularly noteworthy kind before he is crowned with fame, and many a man of splendid natural endowments has fallen short of achieving greatness through some inherent weakness of character or the lack of sufficient inspiration or driving force. Great men not only have to be born great; they also have to achieve greatness; and if they receive their proper recognition in the eyes of the world, greatness has to be thrust upon them besides. Whatever a man may be or do, his greatness as a matter of fact depends upon the position in which the judgment of the world places him.

Great men, it is true, seem to rise higher than their source. Generally they come from ancestry considerably above mediocrity. And I venture to express the opinion that a great man has

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never been produced from parents of subnormal mentality. A great man is more apt to arise if both parents are of very superior ability than if only one parent is not above mediocrity. Where the great man appears to stand far above the level of his immediate ancestors it is due in large part, I believe, to the fact that each parent supplied peculiar qualities lacking in the other, assisted also by qualities from more remote ancestors which may have conspired to furnish the necessary complement of hereditary factors. In addition there may be an element of somatic variability of a favorable kind. With the same inheritance two stalks of corn may attain quite different height due to environmental factors that influence growth. Forces that affect the pre-natal or early post-natal life of the human being may influence his development for good or ill to a considerable degree. After all it may be a relatively small thing that gives the finishing touch to the making of a great man. Heredity affords the necessary foundation; but other things may aid or check subsequent development. One thing is certain and that is you cannot make greatness out of mediocrity or good ability out of inborn dullness by all the aids which environment and education or anything else can possibly offer.

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CHAPTER VI

THE DECLINING BIRTH RATE

"There is no importance in an increasing population; on the contrary, if the population of Europe were stationary, it would be much easier to promote economic reform and to avoid war. What is regrettable *at present* is not the decline of the birth rate in itself, but the fact that the decline is greatest in the best elements of the population. There is reason, however, to fear in the future three bad results: first, an absolute decline in the numbers of English, French, and Germans; secondly, as a consequence of this decline, their subjugation by less civilized races and the extinction of their tradition; thirdly, a revival of their numbers on a much lower plane of civilization, after generations of selection of those who have neither intelligence nor foresight. If this result is to be avoided, the present unfortunate selectiveness of the birth-rate must be somehow stopped."—Bertrand Russell, *Why Men Fight*, p. 197.

"Desire not a multitude of unprofitable children, neither delight in ungodly sons. Though they multiply, rejoice not in them except that the fear of the Lord be with them."—*Ecclesiasticus*, 16, 1, 2.

"Our remote descendants will probably cease to propagate."—Godwin, *Political Justice*, II, p. 528.

ONE of the most striking features of the recent biological history of man is the decline in the birth rate which has occurred in most civilized countries since the middle of the 19th century. The decline began, however, at different dates in different countries. In France it set in during the first part of the last century. In England and Germany it was not marked before the latter quarter of that century. In Russia and the Balkan States it still continues high, Bulgaria even showing a slight increase in the birth rate in recent years. The general facts in regard to the changes in the birth rate in Europe may be seen by consulting the following table:

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Table of the Annual Births per 1000 of the Population for Several Countries of Europe

	England and Wales	Scotland	Ireland	France.	Germany	Austria	Hungary	Italy	Norway	Sweden	Russia	Spain	Belgium	Holland
1871-76..	35.5	35.0	27.4	25.5	38.9	39.3	42.8	36.9	30.2	30.7	50.3		32.6	36.1
1876-80..	35.4	34.8	25.7	25.3	39.2	38.7	44.1	37.0	31.7	30.3	48.4		32.0	36.4
1881-85..	33.5	33.3	24.0	24.7	37.0	38.1	44.6	37.8	31.2	29.4	49.2	36.7	30.9	34.8
1886-90..	31.4	31.4	22.8	23.1	36.5	37.6	43.7	37.3	30.8	28.8	48.7	36.2	29.4	33.6
1891-95..	30.5	30.5	22.9	22.4	36.3	37.3	42.0	35.9	30.3	27.4	48.2	35.8	29.1	32.9
1896-00..	29.2	30.0	23.1	22.0	36.0	37.0	39.7	33.9	30.3	26.9	49.4	34.6	29.0	32.2
1901.....	28.5	29.5	22.7	22.0	35.7	36.8	37.8	32.5	29.6	27.0	48.0	34.9	29.4	32.3
1905.....	27.3	28.6	23.4	20.6	33.0	34.0	36.1	32.7	27.4	25.7	44.8	35.2	26.2	30.8
1910.....	25.1	26.2	23.3	19.6	29.8	32.6	35.7	33.3	26.1	24.7		33.1	23.8	28.6
1912.....	23.8	25.9	23.0	19.0	28.2	31.2	36.2	32.4	25.8	23.7		31.5	23.2	28.1
1913.....	24.1	25.5	22.8	18.8	27.4	29.6		31.7	25.4	23.1		30.3		28.2
1914.....	23.8	26.1	22.6	18.0				31.1	25.3	22.8		29.6		
1915.....	21.8	23.9	21.8						23.8	21.6				

There are no statistics on the birth rate of the United States as a whole. A few states have kept records of births for several years, but they have been admittedly incomplete, although in general they are improving. From various sources, however, it is evident that the birth rate in this country is declining at a rate quite comparable to that of the more civilized nations of Europe. Even with our enormous immigration the increase in the population of the United States has fallen far short of what it was predicted to be by the statisticians of a half century ago who based their estimates on the rate of natural increase existing at that time.

Since we know the number of immigrants annually entering the country, we can estimate the proportion of our population that results from natural increase, and we can, therefore, form a rough estimate of the general birth rate. The United States census, while it gives no statistics on birth rates, enumerates the number of children under five years of age. The diminishing

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number of individuals in this group forms a rough indication of the declining birth rate. This decline is indicated by the following table compiled by Professor Willcox,[1] giving the number of children under five years of age for every 1,000 women between the ages of 16 and 44:

Decreasing Proportion of Children in the United States

Date	*Number of Children under 5 per 1,000 Women 16–44 Years of Age*
1800	976
1810	976
1820	928
1830	877
1840	835
1850	699
1860	714
1870	649
1880	635
1890	554
1900	541
1910	508

It has been calculated by Professor Willcox that if this rate of diminution continues for a century and a half there will be no more children produced. The proportion of children here indicated would naturally be affected by foreign immigration which consists largely of adults. This would tend to decrease the relative proportion of children, but the large number of foreign women among these immigrants who are of child-bearing age, would tend in a few years to make the number of children increase. In other words, if foreign immigration were checked the proportion of children might not after all be greatly reduced, if at all.

During the past few centuries, and especially in the 19th cen-

[1] Pubs. Am. Stat. Ass. 15, 1–15, 1916

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tury, the population of most civilized countries has considerably, and in some cases very greatly increased. The population of England and Wales between 1801 and 1911 has more than quadrupled; that of Scotland has nearly trebled. In the 60 years between 1851 and 1911 the population in Russia has increased from 55,818,000 to 105,651,000; in Austria from 17,525,000, to 28,568,000; in Hungary from 13,192,000, to 20,851,000 and in Prussia from 16,935,000 to 40,163,000. Of all countries on the continent of Europe, France has shown the slowest rate of increase, and in late years the population has been nearly stationary. Ireland since 1851 has suffered an actual decrease of population owing largely to the low birth rate and the extensive migration of her people to America.

The rapid increase in the population of the United States is due to the circumstances that produce a rapid increase in most new countries which have been opened up to settlement by the white race. The early settlers, being generally of a hardy and prolific stock, living for the most part under wholesome conditions, increased at an unusually rapid rate. Their numbers being continually augmented by a rapidly increasing flow of immigrants produced in a few centuries one of the most populous nations of the earth. In Australia and New Zealand, in which we meet with conditions more or less similar to those found in the United States, there has been a similar rapid increase of population, but owing to a more discriminating control of immigration the stock has remained of a more homogeneous character.

The two chief factors in the increase of population in most civilized countries are (1) the great industrial development whereby countries are able to support a much larger number of people than formerly, and (2) the gradual reduction in the rate of mortality which has been effected through advances in medical science, and especially hygiene. Aside from gains or losses through migration, the changes that occur in the number of inhabitants of any country depend upon the relative proportion of births and deaths. Notwithstanding the decline in the birth rate, the natural increase of several countries is higher than it was

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a quarter of a century ago, owing to the fact that the birth rate has not decreased so rapidly as the death rate.

In all countries increase of population has sooner or later to come to a standstill. For a while the surplus humanity may find an outlet by emigrating into new territory. Increased means of production may for a while keep pace with the growing numbers of inhabitants. But in time, growth of population must bring about its own check.

While we must all recognize this fact, the "population question" does not seem so portentous as it did several years ago. The Malthusian doctrine, with its inevitable tendency of humanity to increase beyond the means of sustenance and its various checks to increase, such as war, pestilence and famine, seemed to promise little but a gloomy future of struggle and hardship for the majority of mankind. It is now becoming probable, however, that the automatic checks will not depend so much upon the increase of the death rate as the decrease of the birth rate. There is no longer ground for fearing the scourges that seemed to be the inevitable consequence of a natural law of propagation. There is perhaps more reason to be apprehensive lest the race should fail to reproduce itself.

For most countries there is no immediate danger of race suicide. although it may very well happen that we shall need to be seriously concerned in the future over this possibility. The birth rate in some countries has shown a continually accelerating descent. In Germany during the first ten years of the 20th century the birth rate fell more than in the preceding thirty. The decline has been especially rapid in the cities, the fall in Berlin being more rapid than the fall of the death rate.

Notwithstanding the rapid increase in the population of Germany, there are several German writers who have already sounded the note of alarm lest the rapidly falling birth rate prove a serious menace to the welfare of the empire. As Bornträger has remarked, "The ever more rapid and more intensive and extensive decline in the birth rate which has been deliberately brought about in Germany, is one of the most threatening occurrences of

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modern times, and one which must be absolutely stopped at the earliest moment if we do not slowly but surely go to destruction." Germany, however, is apparently in no greater danger of race suicide than several of her rivals. It is from France that we hear the greatest lamentations over decreasing fecundity, because the danger to national security from this source is imminent. "*Doit elle mourir?*" "*Le suicide d'un race,*" "*Le Problême de la dépopulation*" are the titles of some of the recent publications whose names are suggestive of the pessimistic tone of their contents. Whether the population of France will slowly decrease, no one can say. For the sake of the world as well of France it is to be hoped that some way will be found to check this decline in the birth rate of a people who have contributed so much to the advancement of civilization.

Other nations are rapidly approaching the birth rate of France, but if their fecundity does not sink below what is necessary to maintain their population there is nothing to regret in this fact. When the world becomes as full of people as it can well support, it would indeed be a great misfortune for the birth rate to continue high. When the globe is supporting its maximum population the number would have to be kept within bounds either by increased mortality, or by decreased fecundity, and the latter method is certainly the less disagreeable.

The chief defense that is made of the former method with all the misery it entails, is that it affords an indispensable means of racial advance. In all ages the pressure of population with its consequent tendency of peoples to overflow their boundaries has been a potent cause of war,—in fact it has made war almost inevitable. It may be urged with much reason that the birth rate of superior peoples should be kept high in order that they may conquer and supplant inferior types. The effect of such conflict under modern conditions would be to lead, through the elimination or amalgamation of subject peoples, to an eventual dominance of a comparatively homogenous race. When this point is reached conflict between political groups of much the same blood would have much less biological significance than it has to-day.

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There is no doubt that the dominant tendencies at the present time are in the direction of racial uniformity rather than divergence, and that whether nations remain at peace or engage in war the process of unification will still go on. The ultimate result in any case will depend largely on the relative birth rates of superior and inferior types. The racial character of the survivors will doubtless be influenced according as the final unification will be effected forcibly or peaceably, but which outcome would be the more desirable from the eugenic standpoint is by no means a simple problem. Conflict may be defended as a means of insuring the predominance of the best racial elements. Whether or not it will do so, or whether it is the only or the best method of attaining this end is a complex question, which I shall not attempt to discuss here. Nor is it my intention to touch upon the difficult ethical and political aspects of the effort to maintain a high birth rate, which characterizes the policy of militaristic nations. Certain it is that a high birth rate with the temptations which it brings for nations to overflow their boundaries and encroach upon neighboring territories has led to frequent wars in the past, and will doubtless continue to be a source of strife in the future. The different rates of increase of different nations are bound to bring many difficult situations whose adjustment will seriously tax the resources of those who would maintain the peace of the world.[1]

A most important feature of the decline of the birth rate is the fact that the fecundity of different classes of people is very unequally affected. In the United States we have a marked decline of the birth rate among people of American parentage, while the immigrants who, up to the period of the present war have been arriving on our shores in ever increasing numbers, still continue to produce large families. Owing to the general lack of birth statistics in the United States, estimates must be based upon the age distribution of the population at different decades, and the birth statistics from a few states in which birth

[1] As Prof. Ross has remarked, "The real enemy of the dove of peace is not the eagle of pride or the vulture of greed, but the stork."—*Changing America*.

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registration has recently become compulsory and a few special investigations relative to this subject.

In Rhode Island in 1905, 82.5 per cent of foreign born married women were mothers (15.5 per cent childless), while in the native American wives 71.6 per cent were mothers (28.4 per cent childless). The average number of children born to foreign born married women was 3.35, while the average number among native born married women was 2.06. Since 1885 the average number of children per foreign born married woman decreased from 4.69 to 3.35, or 28.6 per cent while the average number per native born married woman fell from 2.81 to 2.06, or 26.7 per cent.

In Massachusetts in 1900-1905 there were 143 births per 1,000 foreign born women of 15–44 years, while among native born women of the same age limits there were only 63 births. Mr. A. H. Young finds in New Hampshire a situation very similar to what occurs in Massachusetts and Rhode Island. At ages under 20 years the birth rate of foreign born wives exceeded that of native born by only about one-fourth, but at ages from 25 to 34 years the birth rate of foreign born wives was over double that of the native wives. The birth rates of married women of child-bearing ages are shown in the following table taken from data of the U. S. Census:

Fecundity of Women in New Hampshire

	1890	*1900*
Native white married women, 15–45 years	35,717	36,829
Children under 1 year from native born mothers	3,575	3,985
Per cent	10.0	10.8
Foreign born white married women, 15–45 years	11,793	16,093
Children under 1 year from foreign born mothers	2,759	4,054
Per cent	23.4	25.2

The state registration statistics give the average annual number of births per thousand married women of 15–45 years from 1898–1902 as 115.3 for the native born women, and 236.8 for the foreign born women. The presence of a large French-

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Canadian element (50 per cent of the foreign born) tends to raise the birth rate of the foreign born population. In their report on infant mortality in Manchester, N. H., in 1914, Duncan and Duke state that, "although foreign born constitute only about 42 per cent of the total population, foreign born mothers give birth to 67 per cent of the 1,643 infants." In New York City, according to the report of the New York Department of Health for 1909, the birth rate per thousand of native born women is 28.26, while for an equal number of foreign born women it is 109.46, or nearly four times as large.

Hoffmann finds from a study of a number of genealogies of American families, that the average number of children per family sank from nearly 7 in the 18th century to nearly 5 in the first half of the 19th century, and further decreased to less than 3 in the latter part of the 19th century. The studies of Crum have yielded additional evidence of much the same character. A study was made of the genealogical records of 22 American families containing 12,722 wives and 61,115 children. The chief results are summarized in the following table:

The Decreasing Size of American Families

	Before 1700	*1700–49*	*1750–99*	*1800–49*	*1850–69*	*1870–79*
No. of children per wife.....	7.37	6.83	6.43	4.94	3.47	2.77
Percentage of childless wives..	1.81	1.74	1.88	4.07	5.91	8.10
Mothers with 6–9 children....	50.36%	42.89%	40.50%	29.17%	15.71	8.57
Mothers with only 1 child.....	1.81%	4.11%	4.98%	7.96%	13.98%	18%
Average age of marriage.....	21.4	21.7	22.	22.3	22.9	23.1

The families whose records are included in published genealogies represent the older American stock which may be reproducing more slowly than that of more recent native Americans. Benjamin Franklin estimated the average number of children in an American family in the 18th century at 7, and from the study of a number of genealogies I have arrived at approximately the same result.

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It is unfortunate that the data collected by the Censuses of 1890, 1900 and 1910 on the relative fecundity of native and foreign stocks have never been completely tabulated. The Immigration Commission has made an analysis of a part of these data from certain fairly representative regions of the country. The returns used were taken from the Census of 1900. For purposes of comparison a somewhat arbitrary measure of fecundity was employed, namely, the number of children of women who had been married from ten to twenty years. Of these there were 78,432. These comprise women from various sections of the country both urban and rural. The regions studied included the state of Rhode Island, the cities Cleveland, O., and Minneapolis, 48 mainly rural counties of Ohio, and 21 mainly rural counties of Minnesota. In general the women of native white parentage had 2.7 children, while those of foreign parentage had 4.4. The women of foreign parentage were divided into 2 classes, (1) those who migrated to this country, and (2) those both of whose parents were immigrants, parents of mixed native and foreign blood not being considered. Of the first class the average number of children was 4.7, while that of the second was 3.9, the second generation of the foreign born showing a diminution of fecundity though retaining a higher birth rate than the women of native American stock. The percentage with no children was, foreign born first generation, 5.3 per cent, foreign born second generation, 6.3 per cent, native born white 13.1 per cent, negroes 20.5 per cent. Notwithstanding the high percentage of childless wives among the negroes, the average number of children, 3.1, was greater than that of the native white American. Both native and foreign women were found to be considerably more prolific in the rural districts than in the cities.

The fertility of foreign born women varied markedly according to their nationality. This may be seen by consulting the following table giving the average number of children per each wife of foreign extraction:

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Fertility of Foreign Born Stocks in the United States

Italians	4.9	Norwegians	4.7
Bohemians	5.	Austrians	4.6
Finns	5.3	French	4.3
Russians	5.4	Germans	4.3
French-Canadians	5.6	Irish	4.4
English-Canadians	3.5	Swedes	4.2
Poles	6.2	Scotch	3.6
		English	3.4

The peoples from southern and central Europe show a higher fecundity than those from Great Britain and the northern part of the continent. For most cases this is true of the second generation of foreigners as well as the first. Mr. Hill who worked over the data referred to grants that in the southern states the families of the American born may be of larger size. It is questionable, however, if they would be enough larger to make good the losses through death.

When we consider that with our present death and marriage rates nearly four children per married couple are required to replace the preceding generation, we are compelled to conclude that, taken as a whole, the stock represented by American born parents is probably not reproducing itself. It is the aliens and their immediate children who are responsible for the increase of our population. If these were deducted from our numbers we would probably see that the population of the United States would show an actual decrease. Among the people we commonly call Americans race suicide would probably be found to be considerably more rapid than in France.

We are losing such stock as is represented by the Mayflower descendants, the first families of Virginia, and the daughters of the revolution. New England, once so prolific in typical American manhood and womanhood, is now largely filled up with recent immigrants and their children. Recently in connection with one of my students, Miss C. M. Doud, I have been studying the decline of the birth rate in one important group of American

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stock, the Society of Mayflower Descendants.[1] By means of questionnaires we have obtained data concerning families of the California branch of this Society. The size of the family was found to decrease with the recency of the birth of the parents. The size of the family of parents born in successive periods is shown in the following table:

Declining Birth Rate of the Mayflower Descendants

	Husbands & wives born between 1810–1830	*Husbands born between 1830–1840 wives after 1840*	*Husbands & wives both born between 1840–1860*	*Husbands born between 1850–1860 wives after 1860*	*Husbands & wives both born between 1860–1880; families probably completed*	*Husbands & wives both born between 1870–1880*
No. of children.....	6.0	5.6 (4 families)	3.33 (27 families)	3.0 (8 families)	2.11 (45 families)	1.5 (20 families)
Mother's family.....	9.5	...	4.52	4.28	3.54	3.82
Father's family.....	8.0	...	5.15	5.62	3.94	4.0

It is possible that a few children may yet be born to the parents of the last age group, viz., those in which the mothers were born between 1870 and 1880. As only 8 of the mothers in this group were less than 45 years of age, and as all of them are over 38, the children from this group will be very few. Perhaps the average number of children per family of the Mayflower descendants is somewhat larger than our results indicate, but it is not probable that the number of children would be more than two and a half per married couple, a number obviously insufficient to maintain the stock.

Whatever we may say for the eugenic qualities of our citizens of foreign extraction, and many of them doubtless represent an excellent inheritance, we cannot but regard the disappearance of such stock as the Adams, Lowells, Edwards, and Lees as nothing short of a grave national misfortune.

The most serious menace to racial welfare, not only in America, but in most civilized lands, is the relative sterility of superior

[1] *Jour. Hered.*, Vol. 9, 296–300.

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types of humanity. On the other hand, those who are mentally defective or subnormal tend, through their lack of restraint and foresight, to be unusually prolific. The records of the Jukes, Kallikaks, Nams, Hill Folk, Tribe of Ishmael and other notorious defective strains show that these degenerates are distinguished for unusual fecundity which more than offsets their high infant mortality. Dr. Wilmarth in reporting on some cases of the transmission of mental defect has incidentally chosen cases which illustrate the high fecundity which is only too prevalent in this class: "Two children from one family are under our care. From the sheriff, who brought the children, and an intelligent neighbor, I learned that the mother was weak mentally. The father seldom worked but managed to raise his family on what he could obtain in other ways. Not one of the eighteen children was a desirable member of society. The girls drifted into disreputable lives; the boys were idlers and thieves with no moral sense. I know a couple in Pittsburgh, Pa., whose nine children were all idiots of low grade. A family in eastern Wisconsin, the father and mother are both feeble-minded; at least 7 of the 8 children are imbeciles; 5 we have cared for. A couple in this state have nine children, all subnormal, and there are several, to my knowledge, in collateral branches of the family. One feeble-minded woman, now removed from the state, had by different men 18 children in 19 years, she alleges. I have seen only three of her children. These were feeble-minded and especially defective in moral sense." [1]

[1] Dr. C. T. Ewart (*Jour. Mental Science*, 56, Oct., 1910) states that "Dr. Ettie Sayer, in the course of her work for the London City Council, studied the family history of 100 normal families and 100 families where mental defectives were found. The normal families averaged five in number, while families showing abnormality averaged 7.6, or nearly one-third as many more." It is not altogether clear from the account how the average number in the normal families was arrived at. If 100 families were chosen and the average number of children computed, it would not form a fair basis of comparison with the fecundity of the stocks containing mental defectives. Taking the mental defectives, or any lot of individuals however characterized, it is probable that they will be found to come from families of more than the average size. If we draw 100 people at random from the general population, we are apt to get a preponderating number from families of relatively large size, since these present the largest number of individuals to draw from. If we take 100 families and find the average number of individuals they contain, this

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Whetham remarks[1] that, "Feeble-minded women, whether married or unmarried, are remarkably fertile. The workhouse records frequently note that five, six, or seven children have been born before the mother is twenty-five years of age, and she herself may have commenced child-bearing at fifteen years of age or even younger. Most of these children inherit the mental condition of their parents, and where both parents are known to be feeble-minded, there is no record of their having given birth to a normal child. In one workhouse there were sixteen feeble-minded women who had produced between them one hundred and sixteen children with a large proportion of mental defect. Out of one such family of fourteen, only four could be trained to do remunerative work."

"With regard to the fertility of feeble-minded stocks, it has been pointed out that the feeble-minded children from the degenerate families, who use the special schools in London, come, sometimes two or more at a time, from households averaging about seven offspring, whereas the average number of children in the families who now use the public elementary schools is about four." In England until recently (the evil is still not entirely abated) there has been a very effective system for encouraging the propagation of feeble-minded stocks. Girls born in the workhouse were kept as public charges in homes or industrial schools until they were 16, when they were turned loose upon the world. With their generally poor inheritance combined with unfavorable conditions for developing whatever germs of mentality or strength of character they may have possessed, it is no wonder that a large

number will be less than the average size of the families from which we draw our 100 individuals at random. The assumption that averages arrived at by these two methods are comparable is a fallacy which is very common in writings on eugenics, and it is one that very easily escapes notice. In the present case, if the size of the families from which mental defectives came were compared, not with the average size of normal families, but with the average size of the families from which normal individuals came (which is a very different thing) the results would, other things equal, be indicative of differences in the fecundity of the two stocks. It may be that the comparison was made by the latter method in the investigation referred to, although it is not so stated.

[1] *Introduction to Eugenics*, p. 26.

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proportion of these girls drift into immoral lives. They frequently return to the workhouse to have their children who, after being raised at public expense, are then liberated to repeat much the same performance.

The relation between fertility and social status has been studied by a number of investigators. Heron found in London that the districts which afford evidence of prosperity have a low birth rate, while districts in which indications of poverty are common have a high birth rate. It was estimated that while the death rates in the latter districts were higher than in the former, the difference was not great enough to counteract the greater fecundity of the poorer classes. Moreover, Heron showed that sixty years ago the relative fecundity of the classes dealt with was the reverse of what it is at the present time. Bertillon[1] gives the following tabulation of the birth rates per thousand women between 15 and 50 years of age in various sections of four European cities:

Fertility of Women in Different Districts of Large Cities

	Paris	*Berlin*	*Vienna*	*London*
Very Poor Districts....	108	157	200	147
Poor "	95	129	164	140
Comfortable "	72	114	155	107
Very " "	65	96	153	107
Rich "	53	63	107	87
Very Rich "	34	47	71	63

While the figures given may not exactly represent the birth rates of these districts, they doubtless form a fairly close approximation of them. The birth rate of Paris and Berlin measured by the number of annual births per thousand married women is shown in the following table:

[1] Bull. Inst. Internat. Stat., 11, 163–176, 1899.

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Number of Children per 1,000 Married Women in Different Urban Districts

	Paris	*Berlin*
Very Poor Districts.....	142	214
Poor "	128	198
Comfortable "	109	192
Very " "	96	172
Rich "	94	145
Very Rich "	65	121

That similar conditions prevail in American cities is indicated by statistics of the birth rates of different classes in Philadelphia.[1] In expensive residence districts the rate is 18; in the well-to-do districts, 21.4. per thousand; among the American born factory workers it is 24.5, while among the worst paid immigrants it is 41.9. The death rate in the expensive wards is 14.5 per thousand; while it is higher in the slums, viz., 20.5, it does not nearly make up for the difference in the birth rate.

It is not easy to compare the eugenic worth of the American and foreign born elements of our population, and it would be a great error to measure the eugenic value of a stock in terms of wealth or social position. Many people of the most desirable types of inheritance can boast of very little of either of these desirable possessions. No small proportion of poverty in our present economic régime is due to accident, illness or other circumstances for which the unfortunate victims are in no way to blame. Nevertheless, it is undeniably true that many people are poor because their innate shiftlessness, mental inferiority, and unreliability makes them practically unemployable. Such persons, and a good share of their progeny, tend to remain in the ranks of the poverty stricken classes, unable to seize any opportunity that may present itself for improving their condition. It is not uncommon to find pauper pedigrees extending through several generations. People of good stock unless hampered by ill fortune

[1] S. Nearing, *North American Rev.* 197, 629, 1912.

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continually rise out of the ranks of poverty, but those of shiftless habits, dull mentality, and little ambition constitute the kind of poor who are always with us.

A coöperative study made by Pearson and several collaborators (Elderton, Barrington, Lammotte and DeLaski) throws considerable light on the relation between fecundity and the possession of qualities of a socially valuable kind. Several of Pearson's colleagues found in the laboring population of English towns that there was a fairly high correlation between large families and dirty homes (.41), low rent (.31), poor food (.33), insufficient food (.35), low wages of father (.32) and irregularity of employment. We may explain the low rent and the poor and insufficient food of large families as, in part at least, a consequence of their large size. There seems, however, no good reason to suppose that the possession of a large family would have any effect in lowering the wages of the father. Wages are at least a rough measure of the efficiency of the individual worker, and the fact that the men who are poorly paid have a larger number of children than those who receive better wages indicates that the less efficient types have the highest degree of fecundity.[1] Miss Elderton in her elaborate report on the English birth rate says of the artisan classes: "The poorest classes of all, those who cannot provide for themselves but seek public dispensaries and maternity charities for attendance, do not appear to limit their families, for very many have large families running up to thirteen or more."

Dunlop gives data from Scotland based on the number of children per marriage lasting for 15 years, and in which the wives were between 22 and 27 years of age at the time of marriage.

[1] Mr. S. Johnson in studying the fecundity of British workmen found that those with regular employment had on the average in 1908, 2.86 and in 1909–10, 2.71 children, while those with irregular employment had in these years 3.12 and 3.26 children. *Jour. Roy. Stat. Soc.* 75, 534–550, 1911–1912.

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Fertility of Classes in Scotland According to Occupation

Crofters	7.04
Miners	7.01
Agricultural laborers	6.42
General laborers	6.29
Ministers	4.33
Advertisers and solicitors	3.92
Physicians and surgeons	3.91

The marriages considered are naturally more fertile than the average, but they show the difference in the fertility of people of different stations.

A good deal of interesting data has been collected in the last few years concerning the dwindling families of college graduates, and the general conclusion quite uniformly arrived at, and one from which the data leave no opportunity for escaping, is that the college-bred elements of the population are not nearly reproducing themselves. Several years ago President Elliott pointed with alarm to the low birth rate of the graduates of Harvard University. J. C. Phillips, in the *Harvard Graduates Magazine* for September, 1916, has presented a detailed study of the birth rates of Harvard and Yale graduates. Taking the records of classes not later than 1890, to insure dealing mainly with completed families, he finds that about 25 per cent of the Harvard graduates never marry; of those who do, 21 per cent are childless, and that more than three children to a family is a rare occurrence. The decline of the birth rate in Harvard and Yale is shown in the following table:

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Number of Children in Families of Harvard and Yale Graduates

HARVARD

Year	*Children per Married Couple*	*Average per Graduate*
1851–60.....	3.13	1.68
1861–70.....	2.62	1.98
1871–80.....	2.23	1.63
1881–90.....	2.06	1.55
YALE		
1851–60.....	3.32	2.53
1861–70.....	2.69	2.16
1871–80.....	2.23	1.75
1881–90.....	2.04	1.53

Birth rates for the graduates of Wesleyan University are given by Nicolson[1] as follows:

The Diminishing Families of the Graduates of Wesleyan University

Year	*Children per Family of*	
	Men Graduates	*Women Graduates*
1833–40.....	4.49	
1841–50.....	3.46	
1851–60.....	3.27	
1861–70.....	2.90	
1871–80.....	2.53	2.6
1881–90.....	1.96	2.
1891–00.....	1.42	1.37
1901–10.....	.81	.69

The numbers for the last two decades are too small since the families are not complete in either case, but the dwindling of the families is nevertheless evident if these decades are not considered.

[1] *Science*, N. S. 36, 74–76, 1912.

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The decline of the birth rate in two other colleges is shown in the following table:

Families of Graduates of Middlebury and New York Universities

	Number of Children	
Year	*Middlebury*	*N. Y. University*
1803–09	5.6	
1810–19	4.8	
1820–29	4.1	
1830–39	3.9	4.0
1840–49	3.4	3.2
1850–59	2.9	2.9
1860–69	2.8	2.5
1870–74	2.3	
1875–79	1.8	

In general, the graduates of women's colleges show a lower birth rate than the graduates of colleges for men. The marriage rate for women graduates is low. Miss Nearing[1] on the basis of an extended study, says "College women do not marry probably in fifty cases out of one hundred given sufficient time out of college." The following table from Professor Amy Hewes gives the marriage and birth rates of the graduates of Mt. Holyoke College:

The Families of Mt. Holyoke Graduates

Dates of Graduation	*Per Cent Single*	*Per Cent Married*	*Children per Married Graduate*	*Children per Graduate*
1842–49	14.6	85.4	2.77	2.37
1850–59	24.5	75.5	3.38	2.55
1860–69	39.1	60.9	2.64	1.60
1870–79	40.6	59.4	2.75	1.63
1880–89	42.4	57.6	2.54	1.46
1890–92	50.	50.	1.91	.95

[1] Pubs. Am. Stat. Ass., 14, 156–174, 1914.

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In the classes graduating from Vassar College between 1860 and 1892, 53 per cent had married, producing 1.91 children in each family, or an average of one per graduate. The average number of children per graduate up to the year 1900 was .8 of a child. The average for Wellesley graduates between 1875 and 1899 was .83 of a child.

The birth rates of four colleges are summarized in the following table compiled by Miss Nearing:

The Fecundity of Graduates of Colleges for Women

College	*No. of Children per 100 Married Graduates*			
	1870–79	*1880–89*	*1890–99*	*1900–09*
Vassar	207.8	167.3	147.	68.8
Bryn Mawr	...	...	171.5	77.4
Wellesley	...	166.1	110.1	...
Mt. Holyoke	...	...	182.3	91.2

Of graduates before 1901 Smith College had 59.4, Vassar, 83.9, Bryn Mawr, 82.3 and Mt. Holyoke, 73.0 children per hundred graduates.

Women graduates were found to marry, on the average, two years later than the women who do not attend college. Notwithstanding this fact, the fecundity of graduates is not markedly lower than that of non-collegiate women of American birth belonging to the general class from which graduates are recruited.

Professor Cattell has investigated the size of the families of 440 American men of science, choosing only those cases in which the ages of the parents indicated that the family was completed. The data collected show a remarkable low birth rate. It is true that the death rate among the American men of science is unusually small, being "seventy-five per thousand to the age of five years and about one hundred and twenty to the age of marriage." "The marriage rate for scientific men," says Cattell, "is high, 895

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among the thousand [the number investigated] being married. None the less it is obvious that the families are not self-perpetuating. The scientific men under 50, of whom there are 261 with completed families, have on the average 1.88 children, about 12 per cent of whom die before the age of marriage. What proportion will marry we do not know; but only about 75 per cent of Harvard and Yale graduates marry; only 50 per cent of the graduates of colleges for women marry. A scientific man has on the average about seven-tenths of an adult son. If three-fourths of his sons and grandsons marry and their families continue to be of the same size, a thousand scientific men will leave about 350 grandsons to marry and transmit their names and their hereditary traits. The extermination will be still more rapid in female lines."

From the foregoing data we may draw several conclusions regarding the effects of our present differential birth rate.

1. We are probably losing the elements of our population that belong to native American stock. Wherever data have been collected sufficient to base a judgment upon regarding the birth rate of native Americans, it has been shown that, with our existing marriage rate and death rate the birth rate is insufficient to reproduce the population. The increase of our population comes mainly from immigrants and the children of immigrants. The eugenic effect of this is good or bad according to the qualities of the immigrants of foreign born stocks, and this problem cannot be solved in any general or off-hand way.

2. We are losing the elements of our population that have achieved success financially, socially, or in the field of intellectual achievement. Speaking generally, none of these classes is reproducing itself. This condition is quite as bad in Europe, at least in several countries, as in the United States. It constitutes a very serious menace to our present social welfare, and one which is striking at the very roots of our civilization. The menace is all the more dangerous because its effects do not, like those of war, pestilence or famine, obtrude themselves upon our notice. The forces for evil that work insidiously are the most to be feared be-

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cause they may produce great havoc before they are detected, or at least before the extent of their damage is adequately realized.

3. The elements of the population that are of subnormal mentality exhibit at present the highest degree of fecundity. This is the general verdict of most students of the birth rate of different classes of the population. The higher death rate of the subnormals probably does not offset completely their greater fecundity. There are various factors, however, which tend to reduce the fecundity of subnormal classes. Criminals have their families reduced on account of penal servitude, and it is improbable that tramps and hoboes, who as a class are of subnormal mentality, leave sufficient offspring to replenish their stock. Prostitutes, who constitute another subnormal class, are frequently sterile as a result of venereal diseases, and they also purposely avoid having offspring. We possess little data concerning the fecundity of women of this calling. Many of them have had one or more children before entering upon their professional career, and they sometimes marry and bear children after the business of prostitution has been abandoned. Although they come from stocks that are more than usually prolific, it is very doubtful if they produce sufficient offspring to replace themselves.

The subnormal elements of the population thus suffer in several ways an extensive sterilization of their number. We have no means of accurately measuring the extent of the losses to their ranks. Notwithstanding crime, vagabondage, prostitution and a high infant mortality, stocks like the Kallikaks, Jukes, Nams, etc., somehow continue to increase in numbers. If their productiveness suffers from crime and vice, the celibate careers, late marriages and restricted birth rate of the classes in the higher social strata apparently reduce fecundity still more. At any rate, the latter classes in general have a birth rate which cannot fail to lead to extinction. This much is clearly indicated from a variety of sources, while the springs of our defective inheritance have shown no manifest signs of drying up.

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CHAPTER VII

THE CAUSES OF THE DECLINING BIRTH RATE

"Of the thirty-eight physicians [in New York] who were willing to discuss the matter I asked: 'What do you find to be the ideal American family?' Thirty said, 'Two children, a boy and a girl;' Six said 'One child.' One said, 'Having a family is not an American ideal;' and one said, 'Five or six.'"—L. K. Commander, *The American Idea.*

"I wouldn't have another for the world. I had Lucy when I was first married and didn't know any better."—Mrs. C. of New York.

THE practical problem of remedying the evils of the present differential birth rate requires for its solution a knowledge of the causes by which this condition is brought about. Spencer attributed the low birth rate among the intellectual classes to the "antagonism between Genesis and Individuation,"—the utilization of vital energy in cerebration being supposed to diminish, by a sort of compensating loss, the power of producing offspring. He admits that "special proofs that in man great cerebral expenditure diminishes or destroys generative power, are difficult to obtain." Certainly cases enough might be adduced in which men of high intellectual power have shown no lack of fertility, but among women it seems more probable that intense and continued application to mental work might produce at least a partial sterility. A half century ago large families among the intellectual classes were not uncommon. The rapid decline of the birth rate within a couple of generations can scarcely depend upon any deep seated organic changes occurring in the human species. Our changed modes of life with their greater drafts upon nervous energy may have had a certain effect in reducing the natural fecundity of the female sex, but it is questionable if much of the decline in the birth rate can be attributed to this cause.

In interpreting statistics concerning the number of births per thousand of the population, we must consider the effect of de-

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creasing mortality. If people live longer, there is naturally a larger number of them alive at any given time. If each family always produced the same number of children the relative number of births per thousand would decrease as the number of people alive at any given time increased. Therefore, with the same marriage rate and the same degree of fecundity, a community with a decreasing mortality would show a decreasing birth rate, were we to measure birth rates, as is usually done, by the annual number of births per thousand inhabitants.

Marriage rates estimated, as they commonly are, by the number of marriages made annually per thousand of the population, would be changed by both the birth rate and the death rate. With a given number of marriages per annum, the rate per thousand of the population would decrease with an increased birth rate and increase with an increased death rate. In considering the relation of marriage, birth and death rates it must be borne in mind that each of these affects the others as expressed by the method usually employed.

Changes in the birth rate arising from variations in the rate and age of marriage and the death rate may be partly avoided by employing the so-called "corrected births rates" in which allowance is made for changes in these factors according to the method employed by Newsholme and Stevenson or some similar mode of procedure. An index of birth rates for many purposes more satisfactory is afforded by the number of children born annually to every 1000 women of child-bearing age. What method of enumeration is the best depends on the particular use one wishes to make of the data.

Statistics on the birth rate may also be vitiated to a certain degree by immigration and emigration. In the United States, not only foreign immigration, but the frequent emigration of our people from one state to another introduces a source of error into the statistics compiled by the several states. In addition, the vital statistics of our states suffer from other sources of inaccuracy due to the way in which they are compiled. Data on births are faulty owing to incomplete birth registration. Only a few

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states make a serious attempt to compel such registration by law. While physicians and midwives may comply with the regulation for reporting births, there are many children born without attendance, and which, therefore, are frequently not registered. More care has been taken recently in compiling data on births with the result that a larger number are reported. The rise in the birth rate of several of our states is not improbably due largely to this cause. Massachusetts has for many years compiled data on births and has passed laws compelling birth registration, but the U. S. Children's Bureau has made a thorough study of a limited district in that state with the following results: "99 births were found to have been registered twice, 10 births were registered which actually occurred outside the limits of the municipality, 10 births occurred in another year from that in which they were registered;" 123 births for one reason or another were not registered. The errors, which were considerable, happened to offset each other fairly well since the record showed only 14 fewer births than actually occurred.

The birth rate is undoubtedly affected by changes in the age of marriage and in the frequency of marriage, but it is evident that neither of these causes can account for more than a small part of the general decline in the birth rate during the past fifty years. Marriage statistics suffer greatly from inaccuracy of data on the age of marriage. As most people do not consider it a matter of much importance to report the true ages of the contracting parties, the age of the woman especially is frequently stated to be a few years younger than it really is.[1] Conclusions in regard to the effect of the marriage rate and age of marriage on the birth rate, so far as the United States is concerned, must be regarded as tentative. According to the U. S. Census for 1910, there has been for both sexes a gradual advance since 1890, in the percentage of married persons and in the percentage of married, widowed, and divorced persons combined. "In the age groups 15 to 19 years,

[1] For a discussion of what might be called the coefficient of mendacity for different ages of Australian brides see Knibbs, *The Mathematical Theory of Population*, Appendix A, of the Census of Australia for 1911, Vol. 1.

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22 to 24 years, and 25 to 34 years, the percentage married, widowed or divorced was greater in 1910 than in 1900 and in the case of the first two groups it was also greater in 1900 than in 1890." A larger proportion of the population are marrying in the earlier ages than was the case ten or twenty years ago. The falling off in the natural rate of increase of population in this country would not seem to be due therefore to the postponement of marriage.

In England and Wales the marriage rate has remained fairly constant for nearly a century, although exhibiting, as Ogle has shown, a considerable fluctuation due to war and especially to changes in economic conditions, the curve rising and falling concomitantly with the rising and falling of the curve representing the value of exports. The decline in the birth rate has progressed quite steadily without much apparent relation to fluctuations in the rate of marriage. The relatively small changes in the marriage rate in England and Wales are shown in the following table:

Marriage Rates in England and Wales

Year	*Rate per 10,000*	*Year*	*Rate per 10,000*
1820.....	81.5	1880.....	75
1830.....	78	1900.....	80
1840.....	78	1905.....	77
1850.....	86	1910.....	75
1860.....	85.5	1913.....	78
1870.....	81	1914.....	79.5

In Germany the marriage rate has remained fairly constant, rising in some provinces and falling in others. In the cities of Prussia the marriage rates were 1880: 84.5; 1890, 93.5; 1900, 96.5; while for these three dates in the country they were 73, 75.5, and 78.5. Since the marriage rate has risen during the period in which the birth rate has fallen, we cannot attribute much of the fall in the birth rate to variations in the frequency of marriage.

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Marriage Rates per 10,000 of the Population in Germany

	Germany	*Prussia*	*Bavaria*	*Saxony*	*Berlin*
1841–50.....	81	86	66	86	93
1851–60.....	78	84	64	85	97
1861–70.....	85	85	87	89	113
1871–80.....	86	87	84	94	119
1881–90.....	78	80	69	91	107
1891–00.....	82	83	77	91	101
1900.....	85	85.5			
1905.....	80.5	81			
1910.....	77	77.5			
1912.....	78.5	80			

The marriage rate of France shows a considerable degree of constancy over a long period. It reached its lowest figure, 60.5, in 1870, the year of the Franco-Prussian War, and its highest rate, 97.5, in 1872, the year after the war. During the first twelve years of the 20th century the marriage rate in France showed a very slight increase. The marriage rate in France since the beginning of the last century is shown in the following table:

Marriage Rate in France

1801–10.....	76	1902.....	75.5
1810–20.....	79	1903.....	75.5
1820–30.....	88	1904.....	76
1830–40.....	80	1905.....	77
1840–50.....	80	1906.....	78
1850–60.....	79	1907.....	80
1860–70.....	78	1908.....	80
1870–80.....	80	1909.....	78
1880–90.....	74	1910.....	78
1890–00.....	75	1911.....	77.5
1900.....	77.5	1912.....	79
1901.....	78	1913.....	75

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It is clear that the rate of marriage in France can have had little to do with the birth rate which has quite steadily declined since the beginning of the 19th century, even during the various periods in which the marriage rate has increased, especially between 1890 and 1907.

Other countries in Europe show a fair constancy of marriage rates over decennial periods, some having a slight decrease and others exhibiting a slight increase as we approach the present time. In most countries the highest marriage rate occurred in the decade 1870–80, but the lowest appeared at varying periods down to the present.

The reduction in the infant death rate which has occurred in Europe during the last quarter century would tend to depress the marriage rates. On the other hand, the declining birth rate would have an opposite effect. We may avoid these sources of error somewhat (though encountering others) if we estimate the proportion of married women to the total number of women of marriageable age. The following table shows the number of married women of 15 to 45 years per thousand of all women 15 to 45 years:

Proportions of Married Women in Europe

	1870–71	*1880–81*	*1890–91*	*1900–01*
England and Wales.....	519	514	494	492
Ireland.....	422	395	364	330
Sweden.....	457	444	454	444
Germany.....	...	519	515	528
Prussia.....	498	519	519	533
Austria.....	...	520	504	518
France.....	555	549	545	577
Italy.....	540	552	...	561

Reckoned in this way the proportion of women who are married shows a decrease in some countries (England and Wales, Ireland), and an increase in others (Prussia, France and Italy),

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while in others it has fluctuated back and forth. In general, the marriage rates calculated according to the two methods show a fairly pronounced tendency to vary together.

The birth rate would very naturally be affected by the average age of marriage, since with later marriages there is a greater reduction of the child-bearing period. Galton estimates that the expected fertility of women marrying at 29 is to that of women marrying at 20 as 5 to 8. It is a common belief that the average age of marriage is increasing. For some countries this is true, but as the accompanying table shows, this is by no means a general fact. The average age has declined slightly for both sexes in France, Prussia, Bavaria, Oldenburg and Denmark for nearly a half century. For the last quarter of the 19th century it has declined also in Finland, Wurtenburg and Saxony.

Average Ages of Marriage.

	Eng. & Wales		*Prussia*		*France*		*Sweden*		*Bavaria*	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1856-60...					30.50	26.10	30.89	28.41		
1861-65...					30.11	25.80				
1866-70...			29.89	27.22	30.19	25.62	30.86	28.26		
1871-75...			29.81	26.99	30.50	25.79	31.16	28.46	32.3	28.7
1876-80...			29.56	27.08	30.16	25.37	30.78	28.	31.6	28.
1881-85...			29.51	26.27	29.82	25.96	30.19	27.49	30.6	27.6
1886-90...	28.23	25.96	29.65	26.52	29.75	25.11	30.24	27.57	29.1	26.1
1891-95...	28.43	26.16	29.65	26.52	29.80	25.40	30.68	27.64		
1896-00...	28.38	26.21	29.30	26.20	29.65	25.20	30.23	27.33		
1901-04...			28.90	25.70						

In England and Wales the mean age of spinsters has slowly advanced, according to Newsholme, since 1873, (earlier data are rather untrustworthy), the increase from 1896 to 1899 being from 25.08 years to 25.73. There has been a general increase also in Queensland and New South Wales.

The statistics of the average age of marriage (as well as those of the marriage rate) are affected by the frequency of divorce. Where divorces are common there is apt to be a large number of

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remarriages among people of relatively advanced ages. The increase of divorce, although very widespread, has been much more rapid in some countries than in others, and in countries such as the United States, where divorces are rapidly becoming more frequent, the average age of marriage would tend thereby to become considerably higher. Some countries have a separate tabulation of first marriages. The ages of such marriages in England and Wales have shown a slight increase since 1866, but they have decreased in France (since 1851) and in Bavaria. For most countries there are no separate tabulations available.

Age of marriage doubtless affects the differential birth rate since the different classes marry on the average at different periods of life. There is in most countries a tendency for members of the educated and professional classes to marry late. According to Rubin and Westergaard the average difference in the ages at marriage of official and working classes at Copenhagen for 1878–1882 was over 5 years. Of the former only 6.4 per cent were married before 25, while 35.1 per cent of the latter were married at that age. Similar differences were found by V. Fircks. Von Mayr gives the ages at marriage for several classes in Prussia for 1881–86 as follows:

Age of Marriage According to Occupation

	Average age
Official class	33.41
Medical profession	31.76
Artists and writers	30.62
Army, navy, police	29.30
Day laborers	29.40
Metal workers	28.04
Factory employees (male)	27.67
" " (female)	24.62

That the more educated and skilled among the laborers marry later than their less skilled coworkers is indicated from several sources. Rowntree (*A Study of Town Life*, '02) gives the following ages of marriage for skilled and unskilled workers of York:

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Ages at Marriage of Workmen in York

Age when Married	*Percentage of Marriages among Workers*	
	Skilled	*Unskilled*
Under 20	.5	4.2
20–22	18.2	27.7
23–25	30.0	26.5
26–30	27.8	23.5
31–35	9.8	8.1
36–40	3.0	4.5
41–45	4.6	1.4
46–50	2.4	1.4
Over 50	3.7	2.7

That the fertility of different classes is not caused entirely by the greater duration of marriage of the people who marry at an earlier age is indicated by the English statistics on the fecundity of marriages of different durations in the different groups. Marriages of a given degree of duration from two years up to thirty show uniformly a much higher fertility among the laborers than among the professional classes.

Fecundity According to Duration of Marriage of Followers of Different Occupations

(*British Census of 1911*)

	All durations		*0-2 yrs.*		*2-5 yrs.*		*5-10 yrs.*		*10-15 yrs.*		*15-20 yrs.*		*20-25 yrs.*		*25-30 yrs.*	
	Total	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*	*Total*	*Surviving*
General Population	100.0	100.0	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Coal-miners	126.4	120.2	128	126	120	116	124	118	128	112	130	123	126	120	120	116
Agricultural laborers	113.4	119.6	123	124	115	113	115	119	114	119	115	122	110	119	105	115
Boilermakers	110.1	107.3	110	108	108	107	110	108	110	107	111	108	110	107	116	107
Farmers	100.5	109.1	95	98	107	112	108	115	101	110	98	107	94	104	85	97
Carpenters	95.3	98.7	97	99	97	99	95	98	95	98	95	99	95	100	98	100
Cotton spinners	91.9	86.7	95	91	86	83	89	84	92	86	93	87	97	91	96	96
Cotton weavers	81.2	76.9	83	80	80	78	77	73	79	75	84	79	85	81	89	81
Nonconformist ministers	79.8	85.0	68	71	92	97	81	85	79	85	76	82	79	84	92	92
Clergymen (C. of E.)	72.0	82.0	72	75	87	93	84	93	73	83	67	75	58	67	63	71
Teachers	70.3	76.1	68	70	75	79	74	80	70	76	68	74	66	73	74	80
Doctors	64.7	72.1	85	90	83	89	78	84	64	72	57	64	52	60	56	59

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An important circumstance that brings down the birth rate is the increasing urbanization of the population which in many countries has occurred to such a remarkable extent during the past half century. City life affects fecundity in many ways which we need not here attempt to specify in detail. The many conditions which sap the vitality of the urban population, and which are partly expressed in the greater death rate, are doubtless responsible for much of the decline, but the economic, psychological and social factors probably operate more strongly also than in the rural districts. Life in the country is more normal and wholesome than in the city; the children are more of an asset on the farm than they are in the cities and towns, especially since the passage of legislation restricting the employment of child labor; facilities for rearing children are on the average much better in the country; the use of preventives and abortion are less prevalent; and the search for pleasure and the desire for social life have less influence upon the country housewife than upon her urban sister. In general, city life may be said to intensify the action of most of the agencies that are responsible for the diminution of births.

The inadequate birth statistics of the United States afford little opportunity for comparing directly the urban and rural birth rates for the country in general, although fairly reliable data are furnished by a few of the states. However, the census returns give the number of individuals under five rears of age per thousand women between 25 and 45 years in rural and urban communities for the United States as a whole. These numbers are as follows:

Urban white	252
Urban negro	290
Rural white	603
Rural negro	652

With both negroes and whites the number of children under five is much larger in the country than in the cities; and the same statement holds for each group of states taken separately.

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Were we to compare the number of children under five per thousand married women in cities and in rural districts, the latter would still show a preponderatingly larger number of children. The fact that there are more children in relation to the number of women in the rural districts than in the cities is very strong evidence that the former have the higher birth rate. This conclusion is in general corroborated by what is known of the birth rate in cities where there is a tolerably adequate birth registration. The proportion of women in the United States who are or have been married is greater in the country than in cities in the ratio of 64.6 to 57.8 according to the last (1910) census. This of itself would naturally tend to increase the fecundity of rural districts. On the other hand, the proportion of women of childbearing age is greater in cities than in the country, the per cent of white women of 15–44 years in the country being 21.27 per cent and in cities 25.4 per cent, and among negroes 22.5 per cent and 31 per cent.

Cities usually contain a greater number of bachelors and spinsters than are found in the rural districts. Commenting on this peculiar circumstance Weber remarks: "A number of explanations may be offered for such an apparent contradiction. For one thing, rural emigration takes away most of the bachelors and maids, leaving in the country a population with a large proportion of married people; and at the same time that marriages are comparatively infrequent, social circumstances may be such as to impel rural couples to go to the cities for the performances of marriage ceremony. Moreover, in many German cities it is found that city young people often remove to a suburb to begin housekeeping in a cottage of their own; the marriage is thus credited to the city, while the census counts the married couple in the suburb. The most probable explanation, however, is that city marriages take place at an earlier age than country marriages, where the city marriage-rate is the higher of the two, and that they are dissolved sooner by the relatively high mortality to which males are subject in the city. This would account for the larger number of widows in urban populations. Divorce is also

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more frequent in the city. By the re-marriage of widowed and divorced persons, the city marriage-rate is raised, without any real addition to the number of married people as compared with the rural community where the first marriage would have continued longer."

Differences in the age composition of urban and rural communities, and differences in the percentage of women who are married make the crude birth rate a very unsafe index of how fecundity is affected by an urban environment. On account of their higher percentage of people of child bearing age the crude birth rate gives to cities too favorable a showing. Many married women now to go city hospitals to have their children, and the city thereby gets credit for births which really belong to the country. And the figures for urban birth rates are also apt to be higher than the rural on account of more adequate birth registration in cities where the matter can be brought under one administrative control.

Percentage Married in 28 Great Cities of the U. S.

	Cities		*Whole Country*	
	Male	*Female*	*Male*	*Female*
Foreign White	67.3	62.7	65.9	68.1
Native White	57.1	58.0	66.0	67.9
" " Foreign	45.6	54.	48.6	58.8
Negro	59.5	51.9	69.0	65.0
	59.0	58.8	63.8	66.3

Perhaps the most important factor in the situation in the United States is the presence of a relatively large foreign population in the cities. The foreign elements marry early and have a high marriage rate. Their fecundity for these and other reasons is high. In several cities of the United States we have therefore the somewhat unusual condition of a relatively higher birth rate in cities than in the rural districts of the states in which they occur. Thus in Massachusetts in 1916 the birth rate was 24.8, the lowest

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on record since 1880. With the exception of Cambridge which contains a rather high percentage of native born stock all the cities with over 100,000 inhabitants have a birth rate higher than that of the state as a whole (Boston, 25.8; Worcester, 29.6; Fall River 29.2; Lowell, 30.3; New Bedford, 31.0; Springfield, 30.8; Cambridge, 24.5). In Maine in 1916 the general birth rate was 20.45; in 20 of the largest cities it averaged 21.27. In the towns with a relative large number of foreign born the birth rate is, as a rule, relatively higher than in those with more native born inhabitants. The general birth rate for Michigan in 1915 was 26.6 (death rate 13.3). In all the cities it was 27.6 (death rate 14); in cities with over 50,000 inhabitants it was 31.6 (death rate 16.4), and in cities under 5,000 it was 23.2 (death rate 14.5). Statistics from Ohio tell much the same story as may be seen in the table:

Rural and Urban Birth and Death Rates in Ohio

	Birth Rate		*Death Rate*	
	1916	*1917*	*1916*	*1917*
Whole State	21.9	23.4	14.41	14.75
Cleveland	27.4	29.2	14.6	15.5
Cincinnati	18.4	19.0	16.5	16.5
Dayton	22.0	23.8	14.2	14.7
Toledo	29.0	30.4	19.4	19.0
Columbus	20.0	19.9	15.4	15.2
All Cities	23.7	25.1	15.5	16.1

The state of New York gives statistics of the birth rate of native born and foreign born women in cities and rural districts, and hence enables one to obtain direct evidence on the point in question. In 1916 the birth rate of the entire state was 23.4. In New York City which is notorious for its high percentage of alien population the birth rate was 24.5; in the rest of the state it was 22. Taking all cities of the state together, it was 25.6, the birth

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rate in the rural parts of the state being only 18.5. In almost all the cities of the state the percentage of foreign born was greater than in the country. The percentage of foreign born women in cities of over 25,000 was 26.8% as compared with that in the whole state which was only 19.2%. Particularly significant is the fact that the birth rate per 1,000 married women of 15–44 yrs. in 1916 was 72 for the native born and 177.3 for the foreign born in the country, and 69.3 for native born and 174.8 for foreign born women in the cities. Thus in both native and foreign born women of child-bearing age higher fecundity was shown by the country dweller, but the larger proportion of foreign born women in cities made the urban birth rate higher than the rural.

It is probable that much the same relations would be found to be widely prevalent in the United States. In many states there are no birth statistics kept which may be depended upon, and even in those in which birth registration has been most faithfully carried out there is a considerable amount of inaccuracy. The increasing birth rate which some states of the registration area show in the last decade is, I suspect, largely, if not mainly, the result of improving registration of births. The low birth rate and the surprising irregularities in the records which are shown by the statistics of only a few years back naturally destroy confidence in the data. I have taken only the most recent available reports from states in which there is reason to believe that records are sufficiently complete to warrant basing conclusions upon. In these states it is not improbable that the rural birth rates are too low, as it is probable that births have been more carefully recorded in cities then in the country. However, the inaccuracies are, I believe, not sufficient to seriously modify the conclusions drawn from the data.

The evidence afforded by the birth statistics of urban and rural communities is supported by the careful compilations of the Immigration Commission on the birth rates of native and foreign born women. In Rhode Island the average number of children born to women under 45 who were married from 10–20 years in urban and rural communities is indicated below:

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Number of Children per Married Women of 15-45 Years in Rhode Island

	In Cities over 10,000	*In Remainder of State*
Native white, native parentage....	2.4	2.7
" " foreign parentage....	3.9	4.6
Foreign born.....	4.6	4.8
Canadian English, 1st generation..	3.7	4.5
" " 2d " ..	3.3	3.6
Canadian French, 1st generation...	5.8	6.0
" " 2d " ...	4.8	5.1
English, 1st generation.....	3.7	3.9
" 2d "	2.5	2.8
German 1st generation.....	3.8	4.4
" 2d "	2.7	3.4
Irish, 1st "	4.8	4.6
" 2d "	4.3	4.1
Italian.....	5.0	5.0
Scotch, 1st "	3.8	4.1
" 2d "	2.3	3.1
Swedes, 1st "	3.9	4.5
" 2d "	?	?
Other foreigners, 1st generation....	4.2	4.4
" " 2d "	3.3	?
Native negro.....	3.3	3.7

With the exception of the Irish with their higher urban birth rate and the Italians with the same birth rate in city and country, all classes, the foreign born as well as of the native population, have more children per married woman of child-bearing age in the country than in the city. Also the percentage of childless marriages is greater in the cities for both native (19.4 urban, 13, rural) and foreign born (8.4 urban, 6.5 rural).

The study of Cleveland in relation to 48 predominantly rural counties of Ohio showed similar relations to those found in Rhode

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Island. The average number of children per married woman under 45 who had been married 10–19 years is shown below:

Number of Children per Married Woman of 15-45 Years in Urban and Rural Districts of Ohio

No. Children per Married Woman	*Cleveland*	*Rural Counties*
All classes	4	4
Native white, native parentage	2.4	3.4
Native white, foreign parentage	3.3	3.8
Foreign white	4.7	4.6

Most of the foreign nationalities taken singly showed a higher fecundity in the rural counties, although exceptions occurred in the Bohemians, 1st generation of Hungarians, 1st generation of the Irish, Poles and Russians. "In Cleveland," says the Report, "the average number of children (2.4) borne by the native white women of native parentage is only slightly greater than half the average (4.3) borne by the white women of foreign parentage. In the selected rural counties the average number (3.4) borne by the native white women is three-fourths as large as the average (4.5) borne by the women of foreign parentage. The average for the native white women of native parentage is larger in the rural counties than in Cleveland. This is also true of the average for the women of foreign parentage, but not in so marked a degree. In fact, there are some foreign nationalities which appear to have larger families in the city than in the country. But the difference is not very marked and may be due to factors which are more or less accidental and have no causal relation to urban or rural influences." These facts are especially interesting when it is recalled that the crude birth rate of Cleveland is very much higher than it is in Ohio as a whole, and still higher than in rural Ohio.

In Minnesota a comparison of the number of children of native born and foreign born women in Minneapolis and 21 rural coun-

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ties showed a high fecundity for the rural women. "In Minneapolis," says the report just quoted," the average number of children (2.4) borne by the native white American women is but two-thirds the average (3.8) borne by the white women of foreign parentage. In the rural counties the average is 3.4 for the native American women, being again only two-thirds as large as the average (5.2) for the women of foreign parentage. Thus the average is larger in the rural counties, both for the native American and the foreign women."

In Ohio and Minnesota as in Rhode Island the percentage of childless marriages is much greater among the city women, both native as well as foreign born. The per cent of childless marriages in Cleveland was for native parentage 15.2%; for foreign parentage, 6.3%; in the rural counties the ratios were 5.7%, and 5.1% respectively, in Minnesota the per cent of childless marriages was in Minneapolis 12.7 among women of native parentage, and 6.9 among those of foreign extraction; in the 21 rural counties the ratios were 5.1% for native and only 2.7% for foreign women. In all states the percentage of childless marriages was greater in the second generation of the foreign born than in the first.

The data furnished by the Immigration Commission therefore agree with those from New York and elsewhere in showing that the effect of urban life is to depress the birth rate, and that the relatively high birth rates of American cities are due mainly to their relatively high percentage of inhabitants of foreign extraction. The fact that the crude birth rate is frequently higher in cities than in the country has given rise to erroneous opinions in regard to the actual fecundity of urban populations. Thus Bailey remarks in his valuable work, *Modern Social Conditions*, "It was formerly the case that cities were 'man consuming', requiring that their numbers be kept up by immigration from the country. As time went on conditions changed, until to-day the cities furnish a large proportion of their own increase. At first the birth rate in the country was higher than in the cities, but gradually that in the cities has gained until it has surpassed the country rate." Weber states in his *Growth of Cities* that we are

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hardly justified "in making the generalization that city marriages are less fruitful than country marriages. Indeed, the opposite is true in several countries, if the great cities be excepted." Most of the data appealed to in support of this statement are derived from statistics in the 90's and previously. Weber's work was published in 1899, and whatever may have been the relations at that time it is evident that urban birth rates have since fallen more rapidly than the rural. Sweden which at the time Weber wrote had a higher birth rate in the city than in the country has now just the reverse. This is shown in the following table of the birth rate in the cities and rural districts of that country:

Births per 1,000 in Sweden

In City and in Country

Date	*City*	*Country*	*Date*	*City*	*Country*
1821–30.....	31.64	34.97	1906.....	26.15	25.56
1830–40.....	29.14	31.72	1907.....	26.12	25.35
1840–50.....	29.39	31.28	1908.....	26.80	25.35
1850–60.....	32.56	32.81	1909.....	25.71	25.54
1860–70.....	32.95	31.19	1910.....	24.58	24.09
1870–80.....	32.13	30.21	1911.....	23.83	24.05
1880–90.....	31.07	28.65	1912.....	23.03	24.06
1890–1900.....	27.07	27.16	1913.....	22.85	23.45
1900–1910.....	25.87	25.74	1914.....	21.63	23.33
			1915.....	20.16	22.13
			1916.....	19.52	21.70

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In Italy in 1908 and 1911 the birth rate of cities with over 100,000 inhabitants was as follows:

Birth Rates in Italian Cities

City	*Birth Rate*		*City*	*Birth Rate*	
	1908	*1911*		*1908*	*1911*
Rome	24.3	26.5	Messina[1]	29.5	37.2
Venice	29.4	26.0	Naples	29.4	25.5
Turin	20.0	17.7	Palermo	30.5	30.7
Livorno	24.8	24.5	Catania	33.8	28.5
Genoa	22.7	21.9	Bologna	19.8	22.2
Florence	21.0	21.5			
Milan	23.9	23.8	Italy as a whole	33.4	31.5

[1] On account of the earthquake there were 5,021 births in 1908, but the number increased to 16,210 births in 1911.

In Great Britain and Ireland the crude birth rate in many cities is higher than in the countries in which they are located. Relations of city and country in Great Britain are anomalous for several reasons; nevertheless the country districts, so far as our information goes, have a somewhat higher fecundity when this is estimated by the proportion of children to 1,000 married women of child-bearing age. As stated in the report of the National Birth Rate Commission on the Declining Birth Rate, "In 1911 the legitimate birth rates in terms of 1,000 married women, aged 15–45, were for County Boroughs 195, for London 199, Urban Districts 192 and Rural Districts 204."

In her report on the decline in the birth rate in the north of England Miss Elderton states that in order of decrease in the birth rate come "(1) textile and woolen towns, (2) engineering and metal working towns, (3) mining districts, and lastly (4) purely rural districts."

In France in 1913 the crude birth rate in cities of 10,000 or over averaged 18.67. The birth rate for the rest of the population was 19.45 and for France as a whole 18.8. The rate for the rural districts was exceeded only by that of the towns between 5,000

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and 10,000 inhabitants. The conditions just before the war (1913) are shown in the following table:

Births, Deaths and Marriages in France for 1913

	Births	*Deaths*	*Born Dead*	*Marriages*	*Divorces*
Paris	17.12	15.67	1.49	11.21	1.07
Cities 100–500,000	18.98	19.60	1.25	8.47	.61
" 30–100,000	18.23	19.07	1.09	8.15	.58
" 20– 30,000	18.33	20.10	0.96	7	.46
" 10– 20,000	19.06	19.74			
" 5– 10,000	20.46	18.76			
Average of cities	18.67	18.68			
Average of rest of France	19.45				

It will be observed that Paris has a crude birth rate lower than any other class of cities, and that in general (the cities of 100,000–500,000 proving an exception) the birth rate increases as the size of the city diminishes.

It is in Germany, which furnishes a greater wealth of data on the subject than any other country, that we find the clearest evidence of the relative unfertility of city stocks. The subject has been treated by a considerable number of writers (Mombert, Bornträger, Kriege, Roesle, Kaup, Stenger, Ballod) whose verdicts are in general agreement. The following table gives a very general survey of the relations:

Births Per 1,000 Married Women of Child-Bearing Age in Germany

Years	*Entire State*	*In Cities*	*In the Country*
1880–81	322	305	329
1885–86	329	...	...
1890–91	328	297	347
1895–96	317	279	343
1900–01	305	266	337

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Mombert from whom the above table is taken states that legitimate fertility in the cities as compared with the land is lower, has declined more rapidly and began to decline earlier. In the large cities (Grosstädte) the fall in the birth rate has been especially rapid. All of the large cities showed a lower corrected birth rate in 1901 than the country. The average children per 1,000 married women (15–45 yrs) in cities of 40,000 in 1901 was 238 as compared with the rural rate of 337, but this rate was higher than that of most of the larger cities of that year (Berlin, 172, Breslau, 234, Frankfurt, 208, Munich, 225, Dresden, 211, Essen, 328, Hamburg, 194, Leipzig, 209).

Data on urban and rural birth rates are often greatly affected by many factors which tend to obscure the influence of cities *per se*. Much depends upon the kind of industry in which the city populations are engaged. Manufacturing cities have, as a rule, a higher birth rate than cities which are chiefly engaged in commerce, or which are mainly residential. Often the racial composition of cities differs considerably from that of the surrounding country, as is very strikingly illustrated in the United States. To a less extent this is true in Europe where the percentage of persons born outside the country is greater in cities, and especially in large cities, than in rural districts. Cities tend to be centers of racial mixtures, whatever this may imply as regards the birth rate and the quality of the offspring of mixed marriages. It is probable that the ratio of males to females would be increased by this circumstance, but what other biological effects would follow is doubtful. Since the inhabitants of cities may differ from those of the surrounding country in race, religion, education and prosperity, peculiar combinations of circumstances may render even the corrected birth rate of cities higher than that of the country. There is abundant evidence, however, that the usual effect of an urban environment is to check the propagation of the race.

There is little doubt that one factor in the decline of the birth rate is the reduction in infant mortality which has accompanied the fall of the death rate in recent decades. The correlation

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between a high birth rate and a high infantile death rate is not simply a matter of cause and effect as so many of the Neo-Malthusians assume. While large families may not be so adequately supported on a small income as small ones, the association of high birth rates and high infant death rates is to a large extent due to the fact that both have a common cause in the lack of knowledge or prudence in the parents. In families in which the number of births is voluntarily limited, the death of a child is apt to be followed by the birth of another to replace the loss, as is very commonly the case in France. But even where there is no attempt to regulate the propagation of the race there are certain physiological factors which tend to bring about a correlation between high infant mortality and a high birth rate. It is a well-known fact that, while a child is nursing, the mother is much less apt to conceive. Even primitive peoples often take advantage of this fact and nurse their offspring for a long time in order to avoid having others. The death of an infant and the consequent interruption of lactation is commonly followed by another conception. The more rapidly infants die the more rapidly, therefore, new conceptions are apt to occur.

The birth rate has fallen in several cities in Germany much faster than the infant mortality. In Munich, for instance, the birth rate fell from 1876–80 to 1906–09 over three times as much as the infant mortality, and in 349 German cities of over 15,000 inhabitants the birth rate fell from 1901 to 1909 over three times as much as the infant death rate. Mombert has pointed out that in many cities and districts (Frankfurt, Stettin, Cologne, etc.) in Germany the infant death rate has risen while the birth rate has decreased, and in a few cities the birth rate has increased while the infant death rate has decreased.

France shows an unfortunate condition in having a low birth rate and a high infant death rate.

The classes in which the birth rate has fallen most are those in which the habit of nursing offspring has most fallen into disuse. The interruption of lactation would naturally tend to increase fecundity, but it has not done this, largely, no doubt, because it

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has not been allowed to do so. We cannot, therefore, for several reasons attribute to reduced infant mortality a large part of the decline of the birth rate, although this has doubtless been one factor.

The influence of venereal diseases upon the decline of the birth rate, although undoubtedly considerable, is difficult to estimate. No reliable data exists as to the proportion of the population affected by these diseases, although their prevalence is a matter of common knowledge.[1] That the two most common venereal maladies are potent causes of sterility has long been recognized. Gonorrhœa, which, according to several medical authorities, has at one time or another affected more than 50 per cent of the adult male population, is responsible for a large amount of sterility, the extent of which the medical profession has only recently come to appreciate. Through obstructing the vas deferens or epididymis, as well as in other ways, gonorrhœa is a not infrequent cause of sterility in the male sex. Furbringer attributes one-third of all sterile marriages to this cause. Kohern found in 96 sterile marriages 30 per cent due to the absence of sperms in the seminal fluid of the husband. The greatest damage is done, however, by the transfer of the infection to wives, which often takes place even after the disease has apparently ceased in the husband. Gonococcus infection, according to the moderate estimate of Prinzing, causes 13 per cent of sterile marriages. Nöggerath places the percentage of sterility in woman due to this cause as high as 50, and Neisser believes that 45 per cent of sterile marriages are due to gonorrhœa of one or the other sex. This disease is a frequent cause of failure to produce more children after the birth of the first child owing to the rapid extension of the infection after childbirth. The extent to which complete or partial sterility is due directly or indirectly to this cause must be very considerable, although it is not capable of precise measurement.

[1] The best index of the prevalence of venereal diseases in the U. S. is afforded by the examination of recruits in the late war. According to the Report of the Surgeon General for 1919, 5.6 per cent were found to be infected at the time of the draft. This figure includes negroes among whom venereal infections were about seven times as frequent as among the whites.

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That syphilis is another potent factor in reducing the birth rate has long been recognized. Syphilis is a common cause of abortion and of still births, but the percentage due to this disease appears not to be accurately ascertained. Dr. Willey thinks that about 32.8 per cent of total still births are due to syphilis. Dr. Thos. Barlow thinks that the majority are the result of this cause. According to Dr. Prince Morrow (*Social Diseases and Marriage*) "60 per cent of children born of syphilitic mothers die *in utero* or soon after birth. Records of the Leurrenne Hospital which refer almost exclusively to syphilis in prostitutes show that of 165 pregnancies with maternal syphilis, 145 which terminated fatally, while in only 22 did the infants survive, that is, only 1 child in 7 pregnancies." Syphilitic mothers often produce several abortions, after which they may bear living offspring, who, however, being affected with hereditary syphilis are apt to die young. The attempt of the National Birth Rate Commission to elicit some information from various experts who were examined as to the prevalence of abortion due to syphilis, yielded little but guarded expressions of opinion. Reliable data on abortions are practically impossible to procure. While abortion has become more frequent in recent years, the increase is doubtless to be attributed largely to the employment of artificial means.

Venereal diseases are, as a rule, notoriously more prevalent in cities than in rural districts,[1] and hence may constitute an important factor in the greater relative reduction of the urban birth rate. One of the most thorough studies on this subject was made by Guttstadt who sent a questionnaire to the physicians in Prussia, concerning the number of venereal cases treated in April, 1900. Of every 10,000 adult inhabitants of Prussia there were treated:

[1] The relatively high rural rate for gonorrhœa shown by American recruits for the recent war is largely due to the great prevalence of this disease in the negro population which is still mainly rural.

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Venereal Diseases in Prussian Cities

	Males	*Females*
In Berlin	141.9	45.7
In 17 other cities of over 100,000	99.9	27.9
In 42 cities of 30,000 to 100,000	58.4	17.6
In 47 cities with less than 30,000	45.1	16.9
In other cities and rural districts	7.9	2.7

Naturally there are sources of error in these data owing to the tendency of individuals to go to larger cities for treatment. That they indicate a greater liability to infection in the larger cities, however, is confirmed by data on the infections of recruits to the army from various parts of Prussia. Of 10,000 recruits in 1903–05 there were venereal cases as follows:

Venereal Cases in Urban and Rural Recruits in Prussia

Berlin	413
27 other cities over 100,000	158
26 " " 50–100,000	102
23 " " 25– 50,000	80
Small cities and rural districts	44

Dr. Blaschko contributes further to the bad reputation of Berlin in his estimate that of 1,000 men between 20 and 30 years nearly 200 become infected with gonorrhœa and 24 with syphilis per year, and that of men who marry after 30, each has had gonorrhœa twice on the average, and every one in 4 or 5 has syphilis. This is apt to be an over-estimate. The Berlin Gewerbskrankenverein reports the yearly number of venereal infections as having increased from 53.6 per thousand male members in 1892–95, to 87.1 per thousand male members in 1906–7. Of course a considerable number of cases may not have been reported to the organization, so that the estimates are minimal. Dr. W. Claasen, on the basis of medical reports on syphilis in medical benefit organizations, estimates that from 22.5 per cent to 34 per cent of all Berlin workers contract syphilis at some time

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during their lives. Still higher estimates are made by Lenz, although they are based on very unreliable methods. In Denmark (1886–95) venereal infection in Copenhagen, other cities and in the country bore the ratio of 201, 30, and 4 respectively (Prinzing.)

It is impossible on the basis of any statistics that have been compiled to ascertain whether venereal diseases have been increasing or decreasing. Medical opinion on the subject is very divergent. It is only recently possible, owing to the discovery of the Wassermann and other tests for syphilis, to gain any idea as to the extent to which this scourge is disseminated among the population, and no data have yet been compiled that will give an accurate idea of its prevalence. We are much less able to estimate its prevalence in times past.

Since venereal diseases are much more common in cities, and since the city population has been increasing at a relatively rapid rate, it would seem likely that venereal diseases in cities have been on the increase. And if they have increased in the cities it would be only natural that with our greatly increased means of travel they would be disseminated into the small towns and rural districts, leading to an increase also in these communities. We are perhaps justified in attributing the tendency of the birth rate to fall more rapidly in the cities in part to the greater prevalence of venereal disease in urban communities. But how far these diseases have produced a fall of the general birth rate is uncertain.

Of all the factors influencing the birth rate, it is probable that the most potent is the voluntary restriction of births. In many families children do not come because they are not wanted, and in many others the number of children is limited to two or three. The custom of standardizing the family, so common in France, is rapidly spreading to other lands, especially among the members of the higher social strata. Large families are no longer in style, and parents who have many children are often regarded as guilty of a violation of good form, if they do not incur a more serious judgment.

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The means resorted to in order to avoid the responsibility of parenthood vary in different households. The effective method of continence in marriage naturally does not commend itself to the rank and file of the human species. However much moralists may condemn the employment of other means of preventing the arrival of the unwanted child, most of those who regulate their families will doubtless continue to follow prevalent customs. The two methods of interfering with the natural course of reproduction are abortion and prevention of conception. The former method, consisting as it does in the destruction of a life already developing toward a human personality, is condemned in most countries as essentially a form of murder. Procuring abortion, either by the mother's own act or through the agency of another person is commonly adjudged a criminal offense, and any physician or surgeon who is an accomplice in the crime is liable to more or less severe penalties, unless the operation is one which the safety or health of the mother demands. Notwithstanding all the legislation against the traffic in child murder, there are very few convictions on this score. The business flourishes in most civilized countries under the patronage of the rich and influential as well as the poor wage earners, who wish to avoid the burden of large families, and the unfortunate girls who would avoid the disgrace of unmarried motherhood. It is the general consensus of opinion among writers on the subject that abortion is on the increase, that it is more prevalent in the more civilized communities, and more common in cities than in the country. What primitive peoples effect through infanticide, the modern woman accomplishes through recourse to the drug store or the gynecological expert. The thinly veiled advertisements of professional abortionists are to be found in the papers of nearly every city. There is reason to believe that in the United States and elsewhere, conditions are becoming general such as Dr. Iseman has described for New York. "So general is the demand and so common the practice, that in the competition for the traffic the ordinary criminal operator has been practically driven out of the business by the highly skilled and respectable members of the medical

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profession. Up to a few years ago there still remained some rivalry on the part of the lodge doctor, the advertising specialist, the foreign midwife, the massage dens, and the manicurist, but even these had to go before the more dignified, less dangerous, and lawful abortions performed at the dispensaries, clinics, and infirmaries which seemingly for this purpose have multiplied in every section of the city.

"With the advent of this benevolent abortion not alone has the regular medical procurer been shorn of the patronage, but with him has also gone that cautious old tinkerer, the family physician and abortionist, both being superseded by those brilliant specialists of the art, the gynæcologists, whose philanthropic and unfailing tomahawks are whetted for every embryo daring to stray within the confines of a woman's clinic."

It is a well-known fact that at present many women whenever they perceive the first signs of pregnancy rush to their physician for relief. The number of such early abortions is naturally not subject to statistical investigation. But it is a common opinion among medical men that they are exceedingly common, and are becoming increasingly prevalent. The special committee on criminal abortion appointed by the Michigan State Board of Health stated in their report, "To so great an extent is this now practiced by American Protestant women that by the calculation of one of the committee, based upon correspondence with nearly one hundred physicians, there comes to the knowledge of the profession seventeen abortions to every one hundred pregnancies; to these the committee believe may be added as many more that never come to the physician's knowledge, making 34 per cent or one-third of all cases ending in miscarriage; that in the United States the number is not less than 100,000, and the number of women who die from its *immediate* effects not less than 6,000 per annum." (Rep. State Bd. Health Mich., 1881, 104–6.) This estimate was made over 36 years ago. More recently a prominent student of the subject, Dr. W. J. Robinson, estimates that probably from one to three million abortions are practiced annually in the United States.

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A very illuminating study of the problem has been made by Miss Elderton in her Report on the English Birth Rate. As the conditions portrayed are quite typical for industrial communities in this country as well as England, and probably other countries also, it will be of interest to quote rather extensively from this report. Speaking of the city of York, Miss Elderton says, "Preventive measures appear to be largely used by nearly all sections of the population in York, although some of our correspondents are not acquainted with the sale of preventatives in public places. One correspondent finds the source of the falling birth rate not in economic depression, but in the rapid growth of prosperity among the working classes in York, and in particular in the exceptional opportunities for the remunerative employment of unmarried women. These unmarried women—often several in one home, earning good wages—connote that the standard of home comforts is a high one. When these women marry, they will not put up with large families and the resulting poverty, incessant toil and drudgery; if they have any knowledge at all of the means of prevention, they check births. This correspondent does not think there is a large recourse to methods of abortion, but that there is greater acquaintance with methods for preventing conception. Indirectly, therefore, the employment of women, it is suggested, has raised the standard of living and lowered the birth rate. A second correspondent finds that preventives are used more freely in the upper classes of York society, the county and military sets, and to a somewhat lesser extent in the middle and lower middle classes. In the artisan classes means of prevention are not so often adopted, but if pregnancy does occur abortifacients are resorted to. The poorest classes of all, those who cannot provide for themselves, but seek public dispensaries and maternity charities for attendance, do not appear to limit their families, for very many have large families running up to thirteen or more. It is clear, however, that if certain members of this class used preventives, they would not come under observation to the same extent as the normally fertile. . . . The upper classes do not as a rule come under the chemist's observation, they order

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from wholesale dealers and expense is no consideration; they use mechanical more frequently than drug preventives. In the case of abortion, there is no connivance with the medical profession, but women apply for a medicine on the ground of some slight irregularity and then take such large doses as to produce the desired effect. The middle class also as a rule adopts Neo-Malthusian practices; appliances are purchased in chemists' shops, but they are also obtained from various barbers and tobacconists. Among the very poor, although the desire to limit the family is filtering down to them, more natural lives are led; they cannot in fact afford drugs, etc., but they are less 'sophisticated' and act more instinctively. There is no doubt that the habit of artificial limitation is growing rapidly in both the upper and middle classes, but our correspondent's experience brought him more closely in touch with skilled artisans, clerks, small shopkeepers, with from £2 a week income upwards. Those with more than £250 a year tend to a proportionally larger use of mechanical preventives. Voluntary self-restraint, or cohabitation at certain times only has hardly anything to do with the decline in the birth rate in this class. The current tone in the matter may be illustrated by two stories, the one told by a married woman with wide experience, namely, that if you hear a knot of young married women of this class talking together, the chances are that the topic will be the means of prevention, and the second the words of a male acquaintance to our correspondent himself 'on the arrival of one of my youngsters': 'Well, you are a fool,—and you in a chemist's shop!' "

That family limitation was not more prevalent earlier may be in part ascribed to the fact that such a possibility never occurred to the majority of parents. The perpetuation of the race simply went on in a natural way as it does among the lower animals, and however undesirable may have been the results of unrestricted multiplication, relatively little effort was made to check the number of births. The surplus humanity was taken care of by a high death rate, assisted occasionally by war, pestilence, famine, and here and there by infanticide.

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Birth restriction probably would have been much more common in past times had our ancestors the knowledge on the subject that is in the possession of most well-informed persons at the present time. But aside from this circumstance, there is, for several reasons, a greater temptation to limit the family than there was in times past. Our changing modes of life make children less desirable. In most places they are no longer an economic asset. In fact they are becoming an increasing financial burden. Standards of living are being raised. There is an increased demand on the part of women for more leisure and a respite from the burdens which a large family imposes. The desire for luxury and social pleasures leads many a married women to choose a childless life, or to be content with but one or two children. And there is the desire to climb higher on the social ladder (the *capillarité sociale* of Dumont) which is not so easily accomplished with children hanging about the skirts.

A common reason given for not having more children is the inadequacy of the family income. Those responding to the questionnaire sent out by Mr. Webb stated that the causes that led to family limitation were mainly economic. A similar questionnaire distributed by Major Greenwood elicited the reasons for family restriction as follows: economic, 130; health, 90; doubtful, 69. Undoubtedly there are many married couples who would have more children if they had more means to support them. But, as a rule, wealth is no sooner acquired than standards of living are raised and a desire for luxuries increased. The acquisition of wealth, far from creating an increased sense of racial obligation, engenders in most people the conviction that they are legitimately entitled to shift to other shoulders all functions that require a sacrifice of egoistic pleasures.

There is doubtless a primary tendency among human beings, as there is among the lower animals, to respond to increased means of support by an enhanced birth rate. In periods of prosperity there are more marriages and hence a greater tendency to produce children. But the contention of Cauderlier that prosperity in general increases the birth rate is contradicted by a number of

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well-known facts. A sudden accession of wealth may have one effect, but its longer possession, with all the customs and traditions associated with its enjoyment, may have a quite different result. If wealth affords the means of supporting more children it calls into operation a number of secondary factors which tempt its possessors to enjoy life unencumbered by a numerous progeny. It is among the well-to-do who are best able to support and educate their children that the gospel of birth control has secured its largest following. Many comfort themselves with reflections about "fewer and better children," and that "Quality is better than quantity," without considering that without a certain minimum number of children there would soon be neither quantity nor quality. It is doubtful if one person in ten who employs these glib justifications of family restriction has ever seriously reflected on the racial consequences which this restriction may entail. The possession of means of interfering with the normal course of perpetuating life confers a grave responsibility for its wise employment. And it is not surprising that the power should be generally abused. Limiting the family is a perfectly justifiable procedure for a large part of humanity, but it is unfortunate that it is practiced most among those whose excuse for so doing is least.

Many people who practice family limitation are actuated by the desire to provide better for a few children instead of bringing into the world a large family which cannot be adequately supported. It would, however, be a serious racial misfortune if the great mass of reasonably thrifty and intelligent people should, for such a reason, reduce the size of their families below what is necessary to perpetuate their stock. To put family interest above racial welfare is as bad in its effect as to sacrifice the race to the selfish enjoyment of the individual. With most people considerations of the interests of the race are not kept habitually in mind, if they are ever present at all. What is one child more or less in a populous country as compared with the sacrifices needed to feed an extra mouth? This is the concrete question which occurs almost inevitably to every married couple in moderate circum-

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stances who give thought to the larger aspects of perpetuating their kind. With people of good inheritance it is a question of family prosperity versus the general weal. And it is so easy to find a reasonable justification for pursuing the former to the neglect of the latter. There are people in plenty willing to die for their country, but when it comes to raising children for it,—that is a different matter.

It is to be feared that the so-called Neo-Malthusian doctrines which are becoming so widely diffused nowadays are having more effect in extinguishing good inheritance than in checking the large families which are so frequently associated with a squalid existence and a high death rate. As its name implies the Neo-Malthusian movement is an outgrowth of the general doctrine enunciated by Malthus in his celebrated *Essay on Population*. In the words of one of its chief exponents, Dr. C. V. Drysdale, "Neo-Malthusianism is an ethical doctrine based on the principle of Malthus that poverty, disease and premature death can only be eliminated by control of reproduction, and on a recognition of the evils inseparable from prolonged abstention from marriage. It therefore advocates early marriage, combined with a selective limitation of offspring to those children to whom the parents can give a satisfactory heredity and environment so that they may become desirable members of the community. It further maintains that a universal knowledge of contraceptive devices among adult men and women would in all probability automatically lead to such a selection through an enlightened self-interest, and thus to the elimination of destitution and all the more serious social evils, and to the elevation of the race."

This is quoted from the second edition of the author's book, *The Small Family System*, which contains perhaps the best general statement of the Neo-Malthusian doctrine, with an able plea in its behalf. Like many other Neo-Malthusians, Dr. Drysdale sees in family limitation what is perhaps as near to being a panacea for all social ills as any one measure that could possibly be applied. To the adoption of Neo-Malthusian practices is attributed a large part of the decrease in mortality which during the last half

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century has accompanied the fall of the birth rate. A high birth rate commonly goes along with a high infant mortality; hence, it is argued, the latter would diminish if the birth rate were reduced. By doing away with over-population Neo-Malthusianism would tend to exterminate disease and poverty, and by permitting early marriages to take place without incurring the responsibility of parenthood it would materially decrease prostitution and venereal disease. In place of a population living in squalor and ignorance, competing keenly for the bare means of subsistence, and tending through rapid increase to encroach upon neighboring nations, we should have a people with a relatively low death rate, living in comparative affluence, freed largely from the temptations to vice and crime, and enjoying the blessings of peace and contentment. All this through the proper employment of contraceptives!

This vision of the beneficent results of checking over-population has aroused in many all the enthusiasm that characterizes the devotees of a new religion. We have societies for spreading the gospel in various countries, as, for instance, the Malthusian League of England, the ligue Neo-Malthusienne of Paris, similar leagues in Holland, Germany, Austria, Italy, Belgium, Sweden, Spain, and several birth control leagues in the larger cities of the United States. A number of periodicals are devoted, in whole or in part, to the same propaganda, such as the Birth Control Review, Birth Control News, Dr. Robinson's Critic and Guide, The Malthusian (C. V. Drysdale ed.), La Génération Consciente (Paris), Salud y Fuerza (Spain), L'Educazione sessuale (Italy), Die neue Generation (Germany). Much of this teaching finds its way into socialist pamphlets and periodicals which have no small influence upon the birth rate of the better informed workers. Many of the latter take an antagonistic attitude to having large families, not merely because many children make greater demands upon the family income, but believing that, as the population increases, wages, and hence the welfare of the working classes in general, tends to decrease, and believing also, and to a certain extent rightly, that the gospel of fecundity has been

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preached in the interest of capital in order that there may always be a supply of cheap labor, they have come to regard the production of large families as almost an act of class disloyalty. Knowing little of heredity, taught to look upon the differences between human beings as chiefly the result of environment and opportunity, and being impressed with the notion that the ills of humanity have their root in purely social and economic maladjustments, they are apt to set little store by the great variations in hereditary qualities which human beings everywhere present, and to overlook the really vital importance of conserving the best inheritance of the race. It does not seem to them, therefore, a matter of much importance whether they produce their quota of children or not. In fact, it might seem to be a patriotic duty to refrain from having children, so that the next generation would be able to secure a greater per capita reward for its labor.

If a large part of the thinking elements of the working classes hold such views and are thereby led to reduce their families below the necessary minimum for reproducing their kind, we cannot upbraid them for neglecting an important duty, but can only endeavor to dissuade them from carrying family restriction to the point of race suicide.

No Neo-Malthusian who has the least knowledge of the principles of heredity would advocate the restriction of families of desirable parentage beyond the minimum necessary for race perpetuation. Many Neo-Malthusians, however, place so little emphasis on this aspect of the matter that the actual influence of their teaching would be to produce just this result. Dr. Drysdale's book, for instance, is so devoted to condemning the evils of large families and extolling the benefits arising from the small family system that he has practically no word on the evils that would result from an undue restriction in families of desirable inheritance. An indiscriminate advocacy of small families with no indication of how small the families should be, is more apt to cause good inheritance to disappear than it is to check the propagation of bad stock. In this matter, if anywhere in ethics, the

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Aristotelian doctrine of the golden mean finds its ample justification.

We agree that in numerous instances family limitation would confer an inestimable boon. As Dr. Drysdale well says, "There are millions of poor physically and mentally unfit creatures who, if voluntary restriction were known to them, or they were not told it was unhealthy or immoral, would only be too glad to escape burdening themselves and the community with a numerous and weakly progeny. What is the use of deploring the increase of the unfit when the poor mothers among the working classes are only too anxious to avoid the misery of bearing child upon child in wretched surroundings on miserably insufficient wages, and of seeing half their children perish from semi-starvation before their eyes?"

It is argued that the greatest benefits of birth control would result from diffusing the proper knowledge among the classes that form the rather broad belt between mental deficiency and common mediocrity. We cannot reasonably expect that, in this belt, a great deal of respect would be paid to the counsel of sexual abstinence as a means of limiting the family. Since knowledge of the means of preventing conception is so prevalent among the upper ranks of society, why become so righteously indignant about extending the information to the people among whom it would do the most good?

While much has been said against Neo-Malthusianism on hygienic, ethical and patriotic grounds, there can be no doubt that opinion in medical circles and elsewhere is coming to be more favorable to the movement. It is becoming more and more evident that legislation against the dissemination of knowledge on the prevention of conception is futile, if not mischievous. It now has little effect except that of keeping knowledge of the subject away from the more ignorant and improvident, and of indirectly leading to an increase of abortion among all classes. The attempt to make ignorance the bulwark of morality has always broken down, and it might be better to make knowledge of the least injurious contraceptive methods the general property of

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all married couples rather than to keep it under the ban of legal prohibition. There is a considerable amount of sincere moral feeling, and a larger amount of purely hypocritical protest against such a procedure.[1] The question cannot be decided by ecclesiastical authority, or by any sort of *a priori* deduction, but only on the ground of what is most conducive to the welfare of the race. What we need is a judicious combination of the preachments of Dr. Drysdale and Mr. Roosevelt,—family limitation where such is needed, and greater fecundity among those whose inheritance is of superior quality.

[1] Mr. H. Gächte has somewhat ironically pointed out that among the members of the National Committee on the Increase of the Population in France, there were only 578 children to 445 members, or an average of one and a third children per family!

On the pros and cons of birth control the reader may be referred, in addition to the books and periodicals mentioned above, to Beale's *Racial Decay*, a rather rambling, disorganized work, strongly condemnatory of birth control. This work formed the occasion of Mr. Roosevelt's famous article on Race Suicide (*Outlook*, Vol. 97, p. 763) which should be read by everyone interested in the subject. Of purely historical interest is Knowlton's, *Fruits of Philosophy* (a rather sorry production by the way) whose republication in England in 1878 brought about the celebrated trial of Chas. Bradlaugh and Mrs. Annie Besant. Mention may also be made of Mrs. Besant's pamphlet, *The Law of Population*, which ran through many editions amounting in all to several hundred thousand copies. A strong attack on birth restriction is contained in the Rev. R. Ussher's, *Neo-Malthusianism* (Methuen and Co., London, 1897). On the Neo-Malthusian side attention may be called to *Uncontrolled Breeding*, by A. More; *Small or Large Families*, by C. V. Drysdale, H. Ellis, W. J. Robinson and A. Grotjahn; W. J. Robinson's books, *Eugenics, Marriage and Birth Control, Fewer and Better Babies, The Limitation of Offspring;* A. Grotjahn's, *Geburtenrückgang und Geburtenregelung* (Marcus, Berlin, 1914). H. Ellis has discussed the subject in his *Task of Social Hygiene, Essays in War Time*, and in the Eugenics Review for 1917. An interesting series of articles by M. A. Hopkins runs through Harper's Weekly for 1915. A useful bibliography of several hundred references has been compiled by Th. Schroeder (H. W. Wilson Co., N. Y., 1918, 35 cents).

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CHAPTER VIII

NATURAL SELECTION IN MAN

"The conception of the destruction of the less fit as a beneficent factor of human growth must become part of our mental atmosphere, we must look upon it as a chief cause of the mental and physical growth of mankind in the past, not as a blind and hostile natural force carelessly crushing the single life, but as the source of all that we value in the intellect and physique of the highest type of mankind to-day."—Karl Pearson, *The Groundwork of Eugenics*. Eugenics Laboratory Lecture Series, II.

ACCORDING to the Darwinian theory the evolution of life is mainly the result of the operation of natural selection or the preservation of favored races in the struggle for life. Opinions differ greatly concerning the extent to which natural selection acts in the human species. Mr. Darwin considered the factors of human evolution at some length in his *Descent of Man* and while he has recognized the potency of sexual selection and the transmission of the effects of use and disuse of parts, he lays great stress upon natural selection, both in the preservation of the most favored individuals and in the selection of the most efficient social groups in intertribal and inter-racial conflict. "The early progenitors of man," he says, "must have tended, like all other animals, to have increased beyond their means of sustenance; they must, therefore, actually have been exposed to a struggle for existence, and consequently to the rigid law of natural selection. . . Beneficial variations of all kinds will thus, either occasionally or habitually, have been preserved and injurious ones eliminated." Mr. Darwin emphasizes the importance of variations in the direction of greater intelligence and the development of those social instincts which lead mankind to coöperate for mutual defense. These traits which are so characteristic of man would therefore tend to be developed by natural selection during the entire course of human development.

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We often find it stated that in mankind natural selection has been practically done away with by our advances in civilization. We no longer [1] live in fear of wild beasts; human beings seldom die of starvation or succumb to the direct effects of climate. We endeavor to keep alive the weaklings who would perish under a more primitive régime. Everything is done which is rendered possible by our knowledge and skill to prevent natural selection from eliminating the ill-favored members of our race.

Nevertheless the operation of natural selection is far from completely checked. However far science may advance, it will always lie beyond our power to do away entirely with its action. Dr. G. A. Reid in his *Present Evolution of Man* maintains that man's advance "is not mainly an evolution of physical or intellectual strength, as in his remote ancestry, but mainly an evolution against disease." While there are several evolutionary factors which Dr. Reid has not considered in his book, he is doubtless correct in his contention that the course of our development in the past has been greatly influenced by the selective action of various diseases, and that it will probably continue to be so in the future. Races tend, through the action of natural selection, to become immunized to prevalent diseases. Most diseases act much more severely upon some individuals than others. Many people are practically immune to certain diseases, and some races are more or less immune to diseases which in other races have a high fatality. The relative immunity of the negro race to malaria is well known. According to Hirsch (*Geographical and Historical Pathology*, I, p. 245) there died of malarial fevers per thousand of the population in Ceylon

Negroes	1.1
Natives of India	4.5
Malays	6.7
Natives of Ceylon	7
Europeans	24.6

[1] Indirectly, of course, lack of adequate nutrition is a frequent source of death as it predisposes people to die from various diseases. The same may be said of the *indirect* effects of climate.

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In the most malarious districts of the West coast of Africa members of the white race would probably be eliminated in a few generations. Haycraft states that "the black population of Sierre Leone have only a mortality of .24 per cent. from malaria, while the mortality of the white settlers is 47 per cent." Measles, which is a common but not severe malady with us, is said to have swept away 40,000 of the 150,000 of the inhabitants of the Fiji Islands in 1876. Tuberculosis is apparently more fatal among the negroes, American Indians and the races of the South Pacific than it is among ourselves. The Chinese enjoy a peculiar immunity to typhoid fever, and cancer is probably more prevalent in Caucasians than among more primitive races.

These are a few of the facts which indicate that the same selective agency may act very differently upon different racial stocks. The complex of conditions presented by life in India bear more hardly upon Europeans than upon the Hindus. In the United States the conditions, which include economic and social as well as climatic factors, are much more fatal to the negroes than to the whites. According to the last census reports the anticipation of life for white males is 50.23 years and for white females 53.62 years; but for negro males it is only 35.05 years and for negro females 37.67 years.

The effect of selective agencies upon different races doubtless has much to do in determining the present geographical distribution of the races of mankind. The negro population would never invade the arctic circle even if there were no other human competitors; and were it not for their relative immunity to malaria they would probably long ago have been eliminated from Africa by invaders from other lands. As Dr. J. A. Lindsay has pointed out, the selective influence of disease cannot be treated in general terms. Some diseases, like the plague, cholera and typhus produce much greater ravages among the slum elements of the population than among the well-to-do, whereas influenza is much more apt to attack all classes alike. The latter disease causes a much higher death rate among the older people and especially those with pulmonary affections. The common children's diseases,

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whooping cough, measles, scarlet fever and diphtheria are very prevalent among all classes. The mortality of the first three is much greater among the children of the poor, whereas diphtheria when allowed to run its natural course has a high mortality among rich and poor alike. With measles and whooping cough mortality is largely dependent upon general health, whereas with diphtheria this is not nearly so obvious.

Some epidemic diseases are doubtless selective in their nature, eliminating to a greater degree those with weakened constitutions, whereas others apparently possess little selective value so far as can be observed. Some diseases, therefore, may be racial blessings in disguise, whereas others may have simply a depressing influence on the race as a whole. There is evidence to show that in the white race there are different degrees of susceptibility to several diseases correlated with differences in the degree of pigmentation. Baxter, in his study of large numbers of soldiers of the Civil War, concluded that those with a light complexion were more liable to disease and suffered more from their injuries than those with a dark complexion. The proportions of recruits rejected for military service were, among the blonds, 385.2 per thousand, and among the dark complexioned, 325 per thousand. Eye troubles in the two classes were in the proportion of blonds 22 and dark 18. In Scotland, according to Tocher, the incidence of insanity is greater among the people of light colored eyes. McDonald has studied the relation between pigmentation and disease in a large number of children in the hospitals at Glasgow. He finds that in regard to diphtheria, whooping cough, scarlet fever and measles, "the dark-haired, dark-eyed child has considerably more recuperative power than the fair-haired, light-eyed child. The medium-haired medium-eyed child occupies an intermediate position as regards recuperative power." "The closer the type approximates the fair, the less recuperative power it has, and the less resistance it offers to the diseases."

These results are quite parallel to what has often been observed among animals. Darwin states on the authority of Professor Wyman that dark pigmented swine in Virginia eat with impunity

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the paintroot (Lachnanthes) that is poisonous to white swine. Black sheep, according to Heusinger, possess a similar immunity to certain plants injurious to white sheep. And there are cases in which infectious diseases are more fatal to light than to dark colored breeds of animals.

It is generally held that tuberculosis is more apt to attack individuals with defective vitality. The tendency of tuberculosis to run in families has long been recognized, but since it was demonstrated that this disease is caused by bacterial infection, it has not been regarded as truly hereditary. Direct transfer from mother to embryo is exceedingly rare. It is probable, however, that there are hereditary differences in the liability of individuals to become infected. Pearson and his co-workers have collected evidence to show that the correlation between parents and children for tuberculosis (which lies between .4 and .6) is higher than the correlation between the occurrence of tuberculosis and unfavorable environment such as poor housing and bad ventilation. A parent-offspring or a fraternal correlation is not necessarily the result of heredity. It might also be brought about by the transmission of an infection quite apart from heredity. It is argued, however, that since the correlation for tuberculosis in husband and wife where the chances for infection are presumably equally great lies between 0 and .3, and as a part of this correlation is probably due to assortative mating, or the tendency of like or similarly situated individuals to intermarry, the parent-offspring correlation must be mainly the result of an hereditary proclivity to infection.

It may be questioned, however, if tuberculosis is as apt to be conveyed in the marital relation as it is from parent to offspring. If, as many authors now contend, tuberculosis is usually acquired in childhood, often lying latent until some condition causes it to flare up in adult life, the high value of the parent-offspring correlation may be the result of early infection rather than a hereditary diathesis.

On the other hand, autopsies show that the great majority of human beings are infected by tuberculosis some time during

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their lives and generally before adult age. Hamburger states that in Vienna 95 per cent of the children of the poor between 12 and 13 years of age are infected, and he thinks that practically all will be infected before they reach adult life. If it should be established that most people become tuberculous at an early age, the hypothesis that the parent-offspring correlation for tuberculosis is due simply to opportunities for infection will hardly suffice to explain the fact. The generality of early infection is a matter to be considered in interpreting the significance of the correlation. If almost every one has become infected, and thus has the opportunity to develop tuberculosis, and if the existence of the more severe forms of the disease is more closely associated with blood relationship than it is with the surrounding conditions under which tuberculosis is apt to become manifest, the evidence would strongly point to the importance of the hereditary factor. The problem is a difficult one about which there has been considerable controversy, and we shall have to await further insight into the subject before the precise rôle of heredity can be fully established. Should the hereditary factor be a potent one it would indicate that natural selection is acting to remove the stocks with a tubercular diathesis.

That natural selection tends to eliminate stocks with a proclivity to other diseases is evident. Several diseases such as diabetes, Bright's disease, Huntington's chorea and others which are known to be transmitted are not infrequent causes of death. Dwarfism, ichthyosis, xeroderma, albinism, hereditary cataract, and deaf mutism, while not in themselves fatal, may lesson the chances for leaving offspring and hence lead to the extinction of stocks in which they occur. Hæmophilia which is transmitted as a sex linked character would tend inevitably to be eliminated by natural selection since it greatly increases the danger from any wound that causes the loss of blood. Lossen states that 18 out of the 37 deaths in the celebrated Mampel family were due to this malady. The hereditary forms of insanity not only keep their victims from propagating their kind, but they often tend to shorten their lives. Brower and Bannister state that in the

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best regulated asylums the death rate "is hardly less than 7 per cent, even under favorable conditions," which is about four times as great as should exist in well-regulated municipalities of the ordinary population. If, however, we take out certain forms of insanity, such as paresis and organic dementia, we have the ratio somewhat reduced. In any case, however, it will decidedly exceed that amongst the general population. The death rate in asylums is less than that of the insane outside of these institutions. Barr (*Mental Defectives*, p. 131) states that out of 625 cases of mental defectives of whose deaths he had records, "the largest number of deaths occurred between 10 and 20 years; but comparatively few passed the 25th year and exceptional cases appeared from 30 to 40 years." According to Clark and Stowell in the New York City Children's Hospitals and Schools the mortality among the feeble-minded is double that of other children, and the mortality of the lowest grades, idiots and imbeciles, is four times as great as among the feeble-minded. With the higher grades of the feeble-minded the expectation of life is much greater, but among these natural selection takes a relatively heavy toll as is evinced by their high infant mortality.

It is a fair inference that natural selection causes a higher mortality among those who, while not feeble-minded, are below the general average of intelligence. Not only is their station in life apt to be such as to raise their death rate, but through ignorance or lack of the ability to afford the proper surroundings for their children they have a high infant mortality which tends to offset, in a measure, their greater fecundity.

Contrasted with the rather high general death rate of inferior stocks is the relatively low death rate of the classes with exceptional intelligence. Sir Francis Galton has noted that English men of science as a class are long lived, and Cattell finds that the death rate and especially the infant mortality in the families of American men of science is unusually low. The death rate is relatively low in professional classes in general and among others who have achieved a noteworthy success in other fields. If it is said that their reduced death rate is due to better environment

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we must bear in mind that their better environment is to a large extent the result of their belonging to hereditary stocks at least a little above the general average of humanity. If the birth rates of the classes that achieve success by virtue of their inherent superiority were as high or nearly as high as it is among their less favored brethren the general level of ability would doubtless be raised through natural selection. Unfortunately under our present social conditions natural selection and reproductive selection frequently work in opposite directions, and the evidence points to the conclusion that the influence of the latter is generally the more potent.

For a number of years Professor Karl Pearson and several of his associates have been endeavoring to demonstrate by statistical methods that natural selection is actually at work among human beings and to obtain a measure of the intensity of its action. From data on the general health of professional classes which were exposed to much the same environmental influences, Pearson found a parent-offspring correlation of .3824 which is indicative of a fair amount of hereditary resemblance. Longevity was found by Beeton and Pearson to run in families as has long been believed and as in fact common observation seems to show. In selected groups such as the British Landed Gentry and the Peerage where environmental differences play a relatively small rôle, a marked correlation was found between the length of life of father and son and also between the length of life of brothers. Great length of life was also found to be correlated with increased fertility. It is, of course, obvious that up to the end of the reproductive period, the longer people live the more children they may be expected to have. But the fact that the longer women live after their reproductive period the more children they are likely to have in this period indicates that increased fertility and longevity are both the result of a high degree of vitality. "Of two women who both lived beyond 50 years, the longer lived is likely to have had before 50 the larger family." (Beeton, Yule and Pearson.)

Similar results were obtained by Powys from data obtained in New South Wales. Fecundity was found to increase in women

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as their age at death increased from 45 to 65–70 years and then to decrease somewhat. "Childless women and mothers of extremely small families have shorter expectation of life than mothers of moderate sized families." With families of more than six children the mother's expectation of life diminishes. In a memoir by Beeton and Pearson it is remarked: "I [K. P.?] think, therefore, that we can no longer talk of natural selection as an hypothesis. It is in the case of man demonstrably at work either changing in a quantitatively definite manner his constitution as a whole or else necessary to keep that constitution stable. It is now not correct to say as Lord Salisbury said in 1894 of natural selection 'No man, so far as we know, has ever seen it at work.' It is sensibly and visibly at work; a factor in 50 to 80 per cent of the deaths in the case of man is not a slight perturbation . . . it is something we run up against at once, almost as soon as we examine a mortality table."

Attempts have been made to demonstrate the workings of natural selection by studying the changes occurring in the human population of limited districts. Among the most extensive investigations in this field are those of O. Ammon upon the inhabitants of Baden. The people of this duchy were held to consist mainly of two racial elements, a relatively tall, blond, blue-eyed, dolichocephalic "Germanic" race, and a small, dark-haired, dark-eyed, round-headed "mongoloid" race. The long-headed types were found to prevail more in cities and towns than in the country, and the older urban inhabitants were found to be more dolichocephalic than the recent ones. The long heads being the more intelligent, superior stock tended to supplant the round heads in the cities where the struggle for position depends more than in the rural districts upon the possession of superior mental and moral qualities. It is the dolichocephalic, according to Ammon, that form the aristocratic race, fitted by their superior endowments to form a ruling caste. They are found in greater numbers in the higher walks of life and they are relatively more abundant in the higher than in the lower grades of the gymnasia. In the migration of peoples from the country to the city which it is assumed

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has been going on for a long time it is supposed that the greater preponderance of the dolichocephalic race in the city population, and especially in the higher levels of wealth and culture is the result of the action of natural selection in favor of the superior type. The city draws the best of the country stock, and of the inhabitants that have migrated to the country the more dolichocephalic succeed best in the struggle for wealth and power.

We may admit that Ammon has shown that in Baden changes have been taking place in the characteristics of the inhabitants. It is not so clear, however, that these changes have been chiefly the result of natural selection. The racial composition of communities is very apt to change as the result of migration and the operation of differential fecundity. Many of us have witnessed in this country a marked change in the character of the population of restricted localities within a period of a few decades. And it is quite evident that such changes are not due to natural selection. Observation of a change in the inhabitants occurring in a small area and in a comparatively short interval of time will not offer conclusive evidence regarding the factors producing the change. Most of the anthropometric data assembled to prove the operation of natural selection is not convincing in that it does not exclude the operation of other possible causes.

Any consideration of the rôle of natural selection in man must take account of the much discussed question of the selective nature of the infant death rate. The first year is by far the most precarious period of life. The infant mortality rate varies enormously in different countries, according to social and economic conditions and the general enlightenment of the inhabitants. In Chile in 1903 it was over 352 per thousand births. For several decades in most countries of Europe the infant mortality rate has been somewhere between 100 and 200 per thousand. It is high in Prussia, Austria, Hungary and Russia, but exceptionally low in Norway and Sweden. It is low in Australia and lowest of all in New Zealand where it reached the remarkable figure of 51 in 1912. The infant mortality of the United States has been estimated at 124 for 1910, although in the absence of data on the birth rate

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this figure can be considered only as a rough approximation to the truth.

It is a remarkable fact that while the death rate of most civilized countries has been falling for the past hundred years the infant death rate in general should have suffered little improvement and in some countries actually increased up to the beginning of the 20th century. During the past few years much greater attention has been devoted to the subject, and a variety of organizations have been active in checking the inexcusable loss of infant life which has been so long suffered to go on, and as a consequence infant mortality in many localities has very rapidly fallen. In the same country enormous differences in the infant death rate still exist in different towns and sections not far removed from each other, as may be illustrated by the infant mortality rates of the following towns of Massachusetts in 1912:

Chicopee	177
North Adams	113.1
Waltham	86.8
Brookline	55

These conditions are usually associated with the economic status of the inhabitants. The death rate is higher in urban than in rural districts, and it increases in cities with the greater density of the population.

In all places infant mortality is very much higher among the poor. In fact Mr. Ashby states that "poverty is perhaps the first and greatest predisposing factor in infant mortality." Duncan and Duke in their valuable survey of the infant mortality of Manchester, N. H., find that the rate of infant deaths rapidly falls as the income of the father rises. Where the annual earnings of the fathers are less than $450, the infant mortality rate was found to be 242.9. Fathers earning from $650 to $850 lose 162.6 per thousand of their children, while those earning $1,250 and over, lose only 58.3. Among the foreign born mothers of Manchester the death rate was 183.5, while among the native

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born it was 128.1. The relatively preventable character of this mortality is indicated by the fact that length of residence in the United States was found to affect greatly the infant mortality of the foreign born mothers; those mothers who had been here over five years had an infant mortality rate of 165.7, while for those who had been here less than that time the rate was 248.8. An investigation of the infant mortality of Montclair, N. J., by the Children's Bureau gave the infant mortality among the native white women as 49, among the foreign born as 88.1, and among the negroes 151.5. Wolf compiled statistics in Erfurt, Germany, which indicated that out of the one thousand babies born,

505 died among the working class
173 " " " middle "
89 " " " rich "

Dr. John Robertson found the infant mortality in Birmingham, England, in 1915 to be 200 per 1,000 among the poor, and 50 per 1,000 among the middle class and rich. He found that when the father earned less than £1 a week if the mother were employed at a factory the infant mortality was 203, if she were employed at home or elsewhere it was 187, and if not employed 191. If the father earned over £1 a week and the mother was employed in a factory the infant mortality was 123, if employed at home or elsewhere it was 53, and if she were unemployed, 99.

Undoubtedly a large amount of infant mortality is the result of the ignorance and inexperience of mothers. Poor milk, improper feeding, inadequate medical attention, and unsanitary living conditions are responsible for many deaths of infants especially among the poor. Undoubtedly as a result of these conditions large numbers of normal and healthy infants perish. Several epidemics common to infancy and childhood are practically as apt to take the strong as the weak, and with improper care during illness even an exceptionally strong child may die. Many students of the subject consider that the infant death rate is for the most part quite indiscriminate and non-selective in its action.

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From the point of view of racial welfare one should distinguish between the elimination of infants who are destined to produce inferior adults and infants who, though weak, grow up into adults who are strong and healthy. The preservation of the latter class of infants would not lead to undesirable developments, except perhaps in making it necessary for parents to bestow more care upon their new born children. As the human species evolved from animal ancestry infants became progressively weaker and required more and more attention for their successful rearing. Along with this there went an increase in the amount of parental care devoted to the young. Infants may be very poorly adapted to survival in an unfavorable environment and nevertheless form, as adults, the most desirable types of the race. Goethe as an infant was very puny and his life was for a time almost despaired of, but as a man he was exceptionally robust, vigorous and long lived. It is only in so far as infantile weakness is correlated with weakness or defect in later life that the elimination of the less hardy babies would have any relation to racial improvement.

It is probable that despite many exceptions there is a general correlation between weakness in infancy and weakness in later life. Ploetz has adduced evidence to show that infant and child mortality is less in stocks with greater longevity. Part of the data were obtained from records of royal families (fürstliche Familien) of Germany and another part from families mainly of the middle class (bürgerliche Familien). The results may be seen in the following table:

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Longevity of Parents and Mortality of Children

	Year of death of parents	*16–25*	*26–35*	*36–45*	*46–55*	*56–65*	*66–75*	*76–85*	*86 & above*	*Totals*	*Source*
Mother's Children	No. of children	67	396	403	517	712	601	387	67	3,150	Families of aristocracy
	Died before 6 yrs. old	20	133	116	163	194	160	87	4	877	
	Per cent of dead children	29.9	33.6	28.8	31.5	*27.2*	26.6	22.5	6.0	*27.8*	
	No. of children	49	222	384	480	511	514	146	31	2,337	Middle class families
	Died before 6 yrs. old	24	95	157	172	194	180	49	7	878	
	Per cent of dead children	49.0	42.8	40.9	36.0	*38.0*	35.0	33.6	22.6	*38.0*	
	No. of children	116	618	787	997	1,223	1,115	533	98	5,487	Total families
	Died before 6 yrs. old	44	228	273	335	388	340	136	11	1,755	
	Per cent of dead children	37.9	36.9	34.7	33.6	*31.7*	30.5	25.5	11.2	*32.0*	
Father's Children	No. of children	23	90	367	545	725	983	444	33	3,210	Families of aristocracy
	Died before 6 yrs. old	12	29	115	171	200	254	105	1	887	
	Per cent of dead children	52.2	32.2	31.3	31.4	*27.6*	25.8	23.6	3.0	*27.6*	
	No. of children	3	162	228	501	580	551	322	32	2,379	Middle class families
	Died before 6 yrs. old	0	65	83	186	206	202	111	9	862	
	Per cent of dead children	0.0	40.1	36.4	37.1	*35.5*	36.7	34.5	28.1	*36.2*	
	No. of children	26	252	595	1,046	1,305	1,534	766	65	5,585	Total families
	Died before 6 yrs. old	12	94	198	357	406	456	216	10	1,749	
	Per cent of dead children	46.2	37.3	33.3	34.1	*31.1*	29.7	28.2	15.4	*31.3*	

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In both the royal and the middle classes the percentage of children dying under six years of age decreases as the age at death of either the father or the mother increases. In other words, if either parent dies young it greatly decreases the expectation of life for the new born child. How are we to interpret this relationship? It might be urged that the death of one parent would be apt to involve lack of adequate care for the children. It was pointed out that while this might partly account for the death rate in children of the younger parents it would not explain the fact that the child death rate continues to fall during the later age periods in which the parents are so old that their death could not possibly have fallen within the first five years of the life of any of their children. It was also pointed out that in the royal families in which the death of the parent would not leave the child without adequate means of support there is much the same correlation between the longevity of parent and child mortality that is found in the middle class families. The relation of child mortality to the death period of the father in these royal families is especially noteworthy.

The results are attributed by Ploetz to the inheritance of different degrees of constitutional weakness. Natural selection, therefore, acts not merely on the parents who are lacking in vigor, but it picks out their young offspring, and thus tends to eliminate stocks which transmit a defective vitality.

It is probable that a considerable part of the infant death rate that seems to be caused by external factors with little regard to heredity is more strongly influenced by the hereditary factor than is at first apparent. Much has been written on the high mortality of artificially fed babies as compared with those which are breast fed. We might be tempted to attribute this to the great superiority of the mother's milk over the various substitutes which are used to replace it. Certain investigations by Pearson on the infant mortality of breast fed and artificially fed babies of the towns of Preston and Blackburn, England, have shown that the death rate of artificially fed babies depends largely on whether the mothers do not want to nurse their children, or fail to nurse

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them because they are unable to do so or because the children are unable to take mothers' milk. "These results," says Pearson, "suggest that it is not the artificial feeding, but the *health* of the mother which is the dominating factor in the mortality and delicacy of the infant." The precise rôle of heredity here is, of course, not revealed, but the facts indicate that it is more potent than the crude data on the relation of artificial feeding to mortality would indicate.

Much infantile weakness, however, is the product of purely somatic variability, depending upon immaturity of birth, illness or misfortune to the mother and many other fortuitous conditions. Of the many malformations that cause infants to die soon after birth there is in relatively few cases evidence of the hereditary character of the defect. Such variability serves to mask more or less the true hereditary variations that may be present. Natural selection would tend to eliminate the weak or imperfect individuals whether their defects were hereditary or not, but it is only to the extent that the purely hereditary variations are picked out that natural selection is able to produce any racial modification.

A high infant mortality has been considered by some investigators as racially advantageous in that a larger proportion of the congenitally weak are eliminated. The preservation of a larger proportion of the new born would save many weaklings who would produce a deterioration of the vitality of the population. The Eugenics Section of the American Association for the Study and Prevention of Infant Mortality recognized that under present conditions the efforts of the society "must necessarily work some anti-eugenic results," although maintaining, as practically all do, that it is an imperative duty to check infant mortality so far as possible. No one seriously proposes to do away with medicine and hygiene because the death rate in the adult population is to a certain degree selective and it would hardly be consistent to deny the benefits of medical science to the helpless period of infancy. Even those who maintain that a high infant mortality is of racial value generally hesitate to advocate the abolition of efforts to reduce it. In reading the literature on the subject one cannot fail

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to be impressed with the fact that sentiment has considerably influenced opinion on the purely matter of fact problem as to whether the infantile death rate is or is not selective. The problem of how far selection occurs in the early periods of life is one of great difficulty and it is especially important that it be approached in an entirely unbiased spirit. In attacking it by statistical methods it is necessary to be continually on one's guard against falling into the many pitfalls which lie across our path.

One method by which the problem has been attacked is to ascertain the relation between high infant mortality and the expectation of life among the survivors. Several investigators (von Erben, Bleicher, Gottstein and Rahts) have reported that a high infant or child mortality is followed by a relatively low mortality in later life. On the other hand, Newsholme in an elaborate comparison of the infant and child death rates over several districts of England has found that where there is a high infant death rate there is also a high death rate of all children up to the period of adolescence. Koppe has found a high infant mortality correlated with a high death rate in the second year, and Prinzing has found a similar correlation between death in the first year and deaths from 1 to 4 years of age. Sadayuki's results show that in separate provinces of Germany a high infantile and a high child death rate go together. Other investigators (Prinzing, v. Vogt, Peiger, Mullhausen) have found (contra Grassl) high infant mortality to be correlated with inferiority of recruits for military service.

Those who have concluded from these results, as several have done, that the infant death rate cannot be selective have drawn an unwarranted inference. Many conditions which produce a high infantile death rate are apt to cause a high death rate also in childhood and adolescence. Ignorance, poverty, epidemic diseases and unsanitary surroundings take their toll from people of all ages, and the fact that the period beyond infancy is not spared because the first year of life is unduly crowded with fatalities, in no way proves that the death rate is not selective during the whole period. It is not a fair test of the potency of selection to

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show that in a region that has a high infant death rate, the death rate for older children is higher than it is in some other region with a low infant death rate. What we want to know is whether the child death rate is less than it would have been *under the same conditions* if the infant death rate had not been so high. If it should be found that a high infant mortality is generally followed some years later by a reduced child mortality of the *same group and under the same environment* the evidence would point to the selective value of early mortality.

An investigation of this problem was made by Mr. E. C. Snow whose memoir on *The Intensity of Natural Selection in Man* contains evidence of much painstaking and critical labor even though it may leave something to be desired in the way of lucidity of exposition. The data for one study were taken from the Reports of the Registrar General for England and Wales, and those for another were obtained from the vital statistics of Prussia. Correlations were worked out for various districts of England and Prussia between the mortality of early life (1–3 years in different cases) and the mortality of subsequent age intervals. After many corrections for environmental differences and the variable sizes of the cohorts, the data were found to show a negative correlation between the death rates of early periods and those of later periods of life. In other words, a relatively high death rate in the first period renders the death rate of the survivors in the subsequent period less than it otherwise would have been. Such a result is not inconsistent with the conclusion stated previously, that certain regions have a relatively high death rate for several successive years. There may be a more severe selection all through life in one group than there is in another.

It would be a matter of interest to ascertain, though the problem would present many difficulties, whether the death rate tends to be less selective, or in other words more indiscriminate as we approach the period of birth. *A priori*, this would seem to be very probable. There may be some truth in Dr. D. S. Jordan's statement that "a strong child can be killed almost as readily as a weak one when it is very young," and it is when

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infants are very young that the death rate is by far the highest. An indiscriminate death rate not only tends to mask the operation of natural selection, but it interferes with its action. The more the purely fortuitous causes of death are removed the more truly selective the remaining part of the death rate becomes. It is probable that many important causes of infant mortality could be removed without interfering greatly with the kind of selective elimination which is of value in maintaining racial vitality. Certain congenital variations may lessen the chances of survival as an infant, but once the period of infancy is passed there may be no deleterious effect in the later years of life. Immaturity at birth may lessen an infant's chance of life, but after a few weeks have passed there may be no more trouble from this circumstance. The lessening of infant mortality which is now being so successfully accomplished may not be so disadvantageous racially after all. It possibly may be of greater racial advantage to shield infancy as much as possible and thus allow an increase of deaths to occur later in life when the death rate is apt to be more discriminating. It is only those infant traits which are correlated with undesirable adult characteristics which it would be of advantage to have eliminated from the race, and it is not clear what is the best method of securing this result.

There is reason to believe that a considerable part of the infant death rate is due not to any inherent weakness in the infants themselves, but to defects in the stock which are manifested in later years. Just as there may be variations which are injurious to infancy but have no effect on the welfare of an older person, so there are variations which will tend to be eliminated in older persons but which have little immediate effect upon infancy. In the latter class are to be included those inherent defects of mind and character which are most conspicuously revealed after several years of life. While the lower types of mental defectives may be more apt to succumb at all ages, the high-grade morons and people of dull mentality are frequently of good physical constitution, and it is probable that their infants under good care would have as low a death rate as those born of more intelli-

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gent ancestry. The relatively high death rate among the infants of this class is a secondary result of the mental inferiority of their parents. Natural selection tends to eliminate this class of individuals not so much through taking a greater toll from the adults but through the high death rate of their offspring. We have already remarked upon the high infant mortality of such stocks as the Jukes and Kallikaks. Ashby remarks in his volume on *Infant Mortality*, in speaking of efforts to reduce the infant death rate in New York, "The unanimous verdict of the doctors, who have made the observations, are that neither the surroundings of the infant, nor the exact character of the milk obtained, were as important factors in the health of the infant as the intelligent character of the mother. . . . Ignorance and lack of intelligence are thus two of the great evils which we have to contend against, and mothers do not generally appreciate the extent upon which infant life depends on the adoption of simple hygienic precautions." Those who are slum dwellers through low intelligence and natural shiftlessness have a high infant mortality. In so far as unfavorable conditions for infant welfare are the result of the inborn inferiority of parents,—and no one can deny that they are frequently so to a considerable degree,—to that extent natural selection tends to eliminate the stock.

In this connection it would be of interest to consider the selective effect of alcohol. Alcoholism in the parents is associated with infant mortality. Dr. Sullivan has compiled the following data:

	No. of children	*No. of children died in 2 yrs.*	*Percentage of dead children*
Drunken Mothers, 21.....	125	69	55.2
Sober Mothers, 28.....	138	33	23.9

Much more data could be adduced to the same effect, but we shall refer the reader to other sources for fuller information. It is generally recognized that the victims of alcoholism are to a large extent individuals of neuropathic inheritance. Alcohol picks out

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the defective members of the race and if it does not eliminate them directly, it causes or rather augments the death rate of their progeny and hence works toward the extirpation of their breed.

From the standpoint of eugenics the infant mortality that results from inherent incompetence or moral depravity has its obvious advantages. If stocks such as the Jukes, Kallikaks and Tribe of Ishmael had had an infant mortality even higher than it was there would be few who would regret the fact. It would have been much better had these degenerates never been born. But having been brought into the world perhaps the next best thing would have been for them to have died young.

By way of summary the kinds of infant mortality we have distinguished may be expressed as follows:

1. Non-selective elimination. This is of no racial value and not only masks the workings of natural selection, but interferes with the stringency of its action.

2. Selective elimination of non-hereditary characters. We might consider this a racially impotent form of natural selection.

3. Selective elimination of characters of value only during infancy. Racial effect not beneficial beyond rendering infancy more hardy.

4. Selective elimination of infantile weakness or defect which would produce diminished vigor in later life.

5. Selective elimination of infants not in themselves weak or imperfect, but who would develop into socially undesirable persons. They are eliminated in greater numbers because of the incompetence of their parents.

The last two forms of selection are strongly working in the direction of racial advance.

The doctrine that the human species may be in any way improved through the selective elimination of infants has been opposed on the ground that whatever agencies cause babies to die would also involve more or less permanent injury upon the survivors. In commenting on those writers who commend a high infant death rate on account of its selective value, Dr. Saleeby remarks: "But waiving here the observation that 'natural selec-

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tion' is being curiously revived by these inexperienced eugenists just when it is being discarded by biologists, we may note that any process of selection which can be justified must weed out the worthless without damaging the worthy. Such is the presumed action of natural selection. But to talk of natural selection in anything so hideously unnatural as a slum is wildly unscientific. . . . What really happens in a slum, of course, is the damaging of all the life therein." We need not tarry over the reckless statements into which Dr. Saleeby has been led apparently through the warmth of indignant protest against what he has called the "better dead school." We might be tempted to remark that it was "inexcusable" for any one having the least acquaintance with current biological thought and investigation to refer to natural selection as a sort of exploded notion which has been given up by modern biologists. And we might comment on the absurdity of saying that natural selection cannot be operative in a slum because the conditions there are "unnatural." But disregarding these somewhat impetuous pronouncements, it may be said in regard to the main conclusion that the fact that agencies which are inimical to infancy may also deteriorate the quality of the survivors in no wise proves that natural selection is not in vigorous operation. Its effects may not, on the whole, be desirable, but that is another matter. If bad environment weeds out unfavorable germinal variations, while at the same time it stunts the development of the more favorable ones which it spares, the biological, or perhaps we should say the germinal gain might be more than offset by the social loss. It might not profit us to be the product of superior germ plasm if we had to live under conditions in which we could not attain our full development. To how great an extent do the agencies that commonly produce a high infant mortality handicap individuals in their later development? How far is the fact that certain localities with a high infant mortality have a high child and adult mortality due to the handicapping of infancy, and how far is it due to the direct effect of the unfavorable conditions of later years? There is reason to believe that both of these factors

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have a strong influence on the mortality of later life. And there is another factor which may be operative, and that is the influence of unfavorable surroundings on the germ plasm. It is, of course, possible that many conditions leading to a high infant death rate may affect the germ plasm in such a way as to produce variations of an inferior kind. It is on this point that we are in most urgent need of more light. Selective agencies differ in their effect upon the general vitality of the organisms. The problem of how any agent of elimination may affect the race is complicated by its possible action in producing variations in the germ plasm. A high infant death rate caused by agencies with an injurious effect on the germ plasm instead of being a blessing in disguise might prove to be an index of racial decay.

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CHAPTER IX

THE SELECTIVE INFLUENCE OF WAR

"Though, during barbarism and the earlier stages of civilization, war has the effect of exterminating the weaker societies, and of weeding out the weaker members of the stronger societies, and thus in both ways furthering the development of those valuable powers, bodily and mental, which war brings into play; yet during the later stages of civilization, the second of these actions is reversed. . . . But when the industrial development has become such that only some of the adult males are drafted into the army, the tendency is to pick out and expose to slaughter the best-grown and healthiest; leaving behind the physically-inferior to propagate the race."—Herbert Spencer, *The Study of Sociology.*

THE subject of the present chapter really belongs under the heading of the preceding one. Of the many forms of selective elimination which are at work in human society, war is one of the most conspicuous. It involves a struggle for existence in the most literal sense of that term, but whether in general it eventuates in the survival of the fittest depends upon many circumstances which are often difficult to estimate. Although many have written about it as if it consisted merely in the struggle of rival contestants of which the strongest or most skillful worsted his adversary, the biological effect of war is no simple problem. "If it were not for war," says General Bernhardi, "we should find that inferior and degenerated races would overcome healthy and youthful ones by their wealth and their numbers. The generative importance of war lies in this, that it causes selection, and thus war becomes a biological necessity. It becomes an indispensable regulator, because without war there could never be racial nor cultural progress."

The same position has been developed by many writers, some of them militarists, and others who have been led to this view-point

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by what they considered to be the teachings of Darwin. It is only recently that general currency has been given to the idea that war as a selective agent works toward racial degeneracy instead of improvement. One of the chief advocates of the abolition of war, Prof. Novicow, states that "War produces indeed a selection, a choice of the worst. The young men strongest and most healthy go to the war. Among its combatants, the most valiant take the lead. In consequence, the more perfect the individual, the greater his chance to be killed. In most battles it is the best that fall. On the other hand, the feeble and sickly elements, those not enrolled under the banners of war, reproduce themselves, while the flower of the nation is condemned to celibacy or to relations with prostitutes, this leading so often, alas, to the most fatal results."

In this country opposition to war on biological grounds has been carried on vigorously by Dr. D. S. Jordan who for a number of years has been devoting his chief energies to investigating, lecturing and writing on this subject. The readers who wish to find the case against war presented in a forcible and eminently readible manner may be referred to Dr. Jordan's books on *The Blood of the Nation*, *The Human Harvest*, and *War and the Breed*. The reversal of selection which war effects is, according to Dr. Jordan, one of the most powerful forces working for national deterioration. "'The best ye bred' is war's insatiable call. Send us your best, your fittest, your most courageous, your youths of patriotism and your men of loyal worth, send them all and breed your next generation from war's unfit remainder. . . . Like seed like harvest, you cannot breed a Clydesdale from a cayuse, neither can the weakling remnant of a warlike nation breed a new generation of heroes for a new generation's wars."

Large standing armies are dysgenic as well as actual war. Darwin, whose teachings have so often been appealed to in support of militarism, said "In every country in which a large standing army is kept up, the finest young men are taken by the conscription or are enlisted. They are thus exposed to early death

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during war, are often tempted into vice and are prevented from marrying during the prime of life. On the other hand, the shorter and feebler men, with poor constitutions, are left at home, and consequently have a much better chance of marrying and propagating their kind."

Where there is universal military service the best of the youths are taken for recruits and are withdrawn from opportunities for marrying during the period when they are forced to bear arms. Barrack life, at least until recently, has led to the increase of venereal disease which has always been one of the chief evils of military life. Hospital admissions from the armies of Great Britain, United States and several other countries have been frightfully high. The disastrous consequences of venereal infection in later married life need not be dwelt upon. Matters are rapidly improving, however, in this regard, and the recent statistics of the American Army afford a remarkable example of what may be accomplished. Should the venereal peril be overcome perhaps the chief evil of army life would be abolished. In a system of military conscription which takes young men of but 20 years of age and keeps them in training for two or three years it is claimed that the effect of delaying marriage would not be significant. In most cases, however, the returning recruit is more or less delayed in making the economic preparation for marriage, so that this event may take place considerably later than it otherwise would have occurred.

What would seem, *a priori*, to be the effects of war from the principles of heredity and selection Dr. Jordan attempts to substantiate by an inductive study of what the after effects of war have actually been. In their volume on *War's Aftermath* D. S. Jordan and H. E. Jordan give the results of their studies of the effect of the Civil War on the population of Virginia. Their studies consisted of an intensive investigation of two counties, and a more cursory survey of several others, "the whole checked up by the opinions of fifty-five Confederate veterans of exceptional character and intelligence." I quote some of the chief conclusions drawn from the work:

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1. The leading men of the South were part of select companies and these were the first to enlist.

2. The flower of the people went into the war at the beginning and of these a large part (20 to 40 per cent) died before the end.

3. War took chiefly the physically fit; the unfit remaining behind.

4. Conscripts, though in many cases the equal of volunteers, were on the average inferior to the latter in moral and physical qualities, making poorer soldiers.

5. A certain rather small number ("bushmen") fled to the hills and other places to avoid conscription. Others deserted from the ranks and joined them. These deserters suffered much inconvenience, but little loss of life.

6. The volunteer militia companies, having enlisted at the beginning, lost more heavily than the conscript companies who entered later.

7. The result was that the men of highest character and quality bore largely the brunt of the war and lost more heavily than their inferiors. Thus was produced a change in the balance of society by reducing the percentage of the best types without a corresponding reduction of the less desirable ones, a condition which was projected into the next generation because the inferior lived to have progeny and the others did not.

Most of the widows of soldiers never married again and many soldiers' fiancés remained unmarried or married below their previous station. A study of the share of university men in the war showed that a considerably larger proportion fell in battle than of the other men engaged. As a southern officer remarked, "Those who fought the most survived the least." "There is always, in war," says Jordan, "a percentage against the man of intelligence because he is likely to be the man of courage, and the man who will die because he believes it to be the right."

As Bodart remarks, "The officers of an army almost always suffer a much higher percentage of casualties than the men. This is to be explained by the effort of the officer to set before his men a good example in cool, courageous conduct." Haushofer gives the following statistics of the Prussian losses of different ranks in the Franco-Prussian war:

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Generals	46	per	1,000
Staff Officers	105	"	"
Captains, Captains of Horse	86	"	"
Lieutenants	89	"	"
Under Officers and Men	45	"	"

Since in general officers represent a class superior in intelligence and efficiency their enhanced death rate in war cannot fail to have a dysgenic effect.

In his treatment of the biological influence of war it is somewhat unfortunate that Dr. Jordan should have limited himself to the simpler and more obvious aspects of the subject. He has done good service in calling general attention to the dysgenic effect of certain aspects of military selection, but he has given slight attention to or passed over in silence several of its secondary biological results and especially the very important problem of the racial value of group selection. There are some counter tendencies which, while they may not outweigh the effect of losses in battle, are nevertheless of considerable importance. Sickness in most wars carries off more soldiers than fall in battle. According to Kellogg, "In the terrible 20-year stretch of the Napoleonic campaigns the British Army had an annual rate of mortality from all causes of 56.21 per thousand men; the mortality from disease was 49.61 per thousand, leaving the direct loss from gun fire to be only 7.60 per thousand. The British losses in the Crimea in two and a half years were 3 per cent by gun fire and 20 per cent by disease." In our Spanish war we lost ten times as many soldiers from disease as we did in battle. Even in the short Franco-Prussian war the losses by disease slightly exceeded the losses from gun fire. This high mortality from disease affords a certain test of toughness, as it is fair to suppose that those with the weakest constitutions succumb in the largest numbers. This, however, eliminates only the worst of the best and its general value to the race is, therefore, open to question.

Another secondary effect of importance is the influence of war on the civilian death rate and birth rate. This influence varies

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greatly according to the degree to which a nation suffers through hardship, disease and other factors that affect the people who do not bear arms. It is naturally the population of the defeated nation which suffers most. In France, according to Dumas, the civilian death rate, in 1869, just before the Franco-Prussian war was 23.4 per thousand, but in 1870, it went up to 28.3 and in 1871 to 34.8; it then fell in 1872 to 21.9. Nearly every great war is accompanied by the introduction of some epidemic which rages in the civil population. Smallpox, cholera, the plague and various other diseases have been carried from one nation to another by armies and have often led to losses much greater than those sustained by the armies in the field.

In the recent war the population of Belgium and Serbia have been subjected to suffering almost without parallel in modern times, but hardship is no stranger in the land of their oppressors, especially among the poorer classes. The infant death rate has been abnormally high and the birth rate has rapidly fallen since the outbreak of war. The actual and potential losses among the civilian population have been enormous, and it will require many years before the Central Powers can recuperate from the effects of this drain upon their human resources. What is the incidence of this enhanced civilian death rate? For a considerable part of the population who are not fortunately situated it would doubtless, on the average, affect those who are constitutionally weak with especial severity. Ammon maintains that the high death rate during wars is a racial advantage in so far as this is the result of epidemics, and Drs. G. A. Reid and Haycraft would probably agree with him. The racial effect of the death rate would doubtless depend much upon circumstances which vary from war to war. The selective value of epidemics for instance depends greatly, as has been pointed out before, on the particular diseases which are disseminated. Where general massacres are indulged in as in Armenia, or where the inhabitants of certain villages are stood up against a stone wall and shot, nothing can be said of the selective working of the death rate. Long wars are especially apt to work havoc in the general population. But even in the short

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Franco-Prussian war the increase in deaths among the civilian population of France was greatly in excess of the total deaths in the army. The excess of deaths over the number for 1869 was 183,000 for 1870 and 407,000 for 1871, while the total deaths of soldiers and officers for the two years (1870 and 1871) of the war was 140,000. These are grouped by Bodart as follows:

Killed and died of wounds	60,000
Died in prison	17,000
Died in Switzerland and Belgium (after being disarmed)	2,000
Died of disease and exhaustion	61,000
Total	140,000

It is evident that no small part of the biological influence of war must depend upon the effect produced on the civilian population. In a great many cases this must have been much greater than the influence of death on the battle field. The varied character of this effect, however, precludes any treatment of the subject in general terms. Besides, we know as yet but little as to just what, in any case, the biological results have been.

It is urged that a partial compensation for losses in battle is afforded by the greater chance for marriage enjoyed by men who have been in the army. The marriage rate, which is low during war time, goes up quickly after peace is resumed. Nature has endowed the female sex with a commendable partiality for the military hero. This circumstance, combined with the fact that the superior vigor of the returning soldiers would tend to make them more prolific would, it is claimed, keep the more virile stocks from being depleted. We have to consider in this connection, however, the influence of venereal infection which army life has unfortunately tended to intensify and also the after effect of war on the health and longevity of the soldier. As Lapouge has remarked, "à la caserne même et en pleine paix, des détériorations sont produites en nombre par le sur menage, par les typhoides bénignes, par les affections vénériennes. Beaucoup d'hommes

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contractent an moins des blennorhagies, et il n'y a guère d'officier qui n'en compte plusieurs; la syphilis est presque aussi fréquente. Ces deux affections sont d'une importance extrême au point de vue du mariage et de la reproduction."

The effect of wounds, epidemics and hardship tend to leave large numbers of soldiers in a decrepid state, by which they are handicapped economically and are to a certain extent kept from marrying. The superior opportunities for marrying enjoyed by the officers do not eventuate in much racial benefit since the birth rate in military sets is unusually low.

On the whole it is quite probable, I believe, that the effect of military selection is dysgenic. So far as the direct effect of conflict is concerned there would be little doubt of this and it has been admitted by many who have claimed that war in general is to be commended on biological grounds. It is a matter of serious doubt whether the counteracting factors come near outweighing the selective effect of battle.

There have been several attempts to show that the children born during war time do not develop into such large and vigorous men as those who are born before or after the war, and who therefore come to a larger degree from fathers who were in military service. Kellogg states that the statistics kept by the French Government on the physical character of recruits show that "the average height of the men of France began notably to decrease with the coming of age, in 1813 and on, of the young men born in the years of the Revolutionary Wars (1792–1802), and that it continued to decrease in the following years with the coming of age of youths born during the Wars of the Empire. Soon after the cessation of these terrible man-draining wars, for the maintenance of which a great part of the able-bodied male population of France had been withdrawn from their families and the duties of reproduction, and much of this part actually sacrificed, a new type of boys began to be born, boys indeed that had in them an inheritance of stature that carried them by the time of their coming of age in the later 1830's and 1840's to a height one inch greater than that of the earlier generations born in war time. The

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average height of the annual conscription contingents born during the Napoleonic Wars was about 1625 mm.; of those born after the wars it was about 1655 mm." Exemptions for infirmities ran nearly parallel with exemptions for undersize.

The researches of Lapouge on the height, color and head form of recruits born in the cantons of Hérault just before, during and after the Franco-Prussian War offer interesting results. The classes of recruits born in 1871 (during the war) were, with the exception of those in a few urban cantons, shorter than those born in 1867. Those born in 1871 were of lighter complexion than the recruits of preceding and succeeding years. It was found that in Hérault the blonds furnished an undue proportion of those who were rejected for military service. The recruits born in 1871 were characterized by an unusual degree of brachycephaly while those born in 1872 had a dolichocephaly no less exaggerated, the one class being with heads broader than the average, the other with heads narrower than the average. It has been objected by Steinmetz and Whetham that the smaller size of the recruits born in 1871 is due, not to selection, but to the stunting effects of the hardships entailed during the war. Granting that this might account for their lower stature, it could not explain the relatively large number of blond and brachycephalic types. The latter seem to have preponderated among the classes of rejected recruits.

In any evaluation of the biological effects of war we must consider not only the characteristics of the individuals who are destroyed in each country, but the effects of the victory of one group of contestants over another group. Clans, tribes and nations function as units in the struggle for existence. Other things equal, the group with the greatest military efficiency will be victorious. Even though the selective elimination within each group should be dysgenic, the survival of a superior people may lead to a racial advance. There can be little doubt that what may be called group selection has proven of great importance in the evolution of the human species. It has placed a premium upon the virtues of fealty, reliability, sympathy and all those

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other altruistic traits which promote harmonious coöperation and social efficiency. Through its influence in moulding human nature man has become a social animal. Those groups in which sympathy, mutual helpfulness and loyalty were best developed would naturally prevail over others in which the purely individualistic propensities dominated over the social impulses. Human nature with its pugnacity, its combination of self-assertion and subordination, and the various herd instincts by which at times it is so powerfully moved has been fashioned in the stern school of conflict.

Undoubtedly warfare among our primitive human ancestors was an institution with very different effect on the race than war among civilized peoples. When practically the whole tribe went to war the effect would more often be the preservation of the most vigorous and capable men in the hand to hand encounters which are characteristic of primitive peoples. Primitive warfare was more nearly on the level of the conflicts between our animal ancestors. Its results were probably eugenic rather than dysgenic, both as regards individual selection and the selection of rival groups. Walter Bagehot who was one of the first to emphasize the importance of group selection (it had been recognized by Darwin) remarks in his able and original work on *Physics and Politics*, "What makes one tribe . . . to differ from another is their relative faculty of coherence. The slightest symptom of legal development, the least indication of a military bond, is then enough to turn the scale. The compact tribes win, and the compact tribes are the tamest. Civilization begins, because the beginning of civilization is a military advantage."

When human beings possess only a very small amount of culture, differences in the innate endowments of rival groups must have frequently, if not usually, played a decisive rôle in the determination of supremacy. There can be little doubt that as man becomes more of a social animal he becomes more of a warlike animal. One of the most common results of the evolution of animal societies is the increase of the instincts of pugnacity which are developed hand in hand with instincts for mutual support and

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coöperation. We need only to compare the behavior of ants, termites, and the social bees and wasps with the activities of the unsocial relatives of these insects to be impressed with this fact. Man cannot be compared with these insects in regard to the extent to which the purely social instincts have been developed; he is still very much of a self-centered, individualistic sort of creature. How many ages of bloody conflict it has taken to endow human beings with their present rather imperfect adaptation to social life we can only estimate in a very approximate way. The teachings of history, the observations of the present customs of primitive races and what little information can be gleaned of the civilization of early human inhabitants of the earth indicate that human beings have evolved under the stress of keen competition, not only with the forces of nature, but at more or less frequent intervals with other members of their own species. As Huxley has remarked, "However imperfect the relics of prehistoric man may be, the evidence which they afford clearly tends to the conclusion that, for thousands and thousands of years, before the origin of the oldest known civilizations, men were savages of a very low type. They strove with their enemies and their competitors; they preyed upon things weaker or less cunning than themselves; they were born, multiplied without stint, and died, for thousands of generations, alongside the mammoth, the urus, the lion, and the hyæna, whose lives were spent in the same way; and they were no more to be praised or blamed, on moral grounds, than their less erect and more hairy compatriots."

If warfare had been dysgenic in its effects during the early periods of human development we may well wonder how the race should ever have arrived at its present high estate. But as civilization advances, and as human beings become organized into larger and larger social groups the character of warfare gradually changes. With the development of armies which carry on their operations often at a distance from the civilian population, and especially since the perfection of fire arms, the advantages in favor of the strongest and most skillful warrior were decreased. Wars of extermination which are not uncommon

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among barbarous tribes and which were carried on by peoples of the cultural level of the Children of Israel and occasionally by those more advanced may have had a eugenic effect. Leading as they did to the supplanting of the conquered by their conquerors their general result must have been a gradual replacement of less efficient by more efficient peoples. But in modern warfare the vanquished are not exterminated. They are usually not dispossessed of their territory and after peace is declared they may multiply more rapidly than their conquerors. Our own Civil War certainly led to no desirable results from the viewpoint of group selection. Both sides lost much of their best blood, and it cannot be said that either side was the superior of the other in hereditary qualities. Between wars such as this and the encounters of groups of primitive man there may be very varied kinds of biological effect depending on the varied methods of waging war, the character of the contestants and the nature of the final settlement of the conflict. Wars between the higher and lower races, such for instance as those which led to the replacement of the aborigines by the Anglo-Saxon are doubtless productive of racial advance. The great extension of this enterprising people owes much to a series of successful wars against the less favored peoples who were found to be in the way. It cannot be denied that wars between subdivisions of the white race may have resulted in racial improvement, but it would be unsafe to claim this for most of them. Theoretically it is easy to justify war among modern peoples by saying that it is the best endowed group which is most apt to prevail, and therefore the best condition for racial advancement is afforded by giving free play to group selection. This is the favorite standpoint of those who would justify war on biological grounds. As Steinmetz has pointed out in his able *Philosophie des Krieges*, modern wars, while they do not directly lead to extermination may leave a people so crippled, devoid of energy, spirit and enterprise that its life tends to stagnate and its population eventually decreases. Headley remarks in his *Problems of Evolution* "Though it can never happen that any of the European nations, even in the

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event of a great war ending in the complete victory of one side, will disappear in the sense that it will have no descendants, yet the number of its descendants depends very largely on wars and menaces of war. The country that secures the best of the earth will send out more colonists than the country that has to send its sons to live among foreigners and speak a strange language."

Results such as are here described have probably been produced in a few cases, but it is doubtful if many of the wars that have been waged in modern Europe have worked out in this way. So far as any racial effects are evident it is not improbable that most European wars have been injurious to all parties concerned. However defeat may have influenced national spirit it does not seem to have produced a very obvious effect on the birth rate. The successive defeats sustained by Austria in the 19th century have not hindered the rapid growth of her population. A victorious career does not affect so much the growth of a people as the expansion of a nation, which is generally a very different thing.

National boundaries are of interest to the politician and historian, but to the student of racial biology they are mainly a source of confusion. Poland was obliterated as a nation, but, despite a considerable amount of mistreatment, the Poles have continued to multiply at a rate that has given their conquerors a certain amount of uneasiness. It is not to be inferred, however, that it is a matter of indifference from the biological standpoint whether people do or do not constitute a nation. Moreover in Europe at present the divisions of ethnic stocks are so crossed by national boundaries that strife between peoples would throw most countries into a many-sided civil war.

The studies of the actual effects of war from the viewpoint of group selection is an almost untouched field. The difficulties in the way of adjudging the biological value of the wars that have occurred between civilized states are many and formidable. We know little of the differences in innate mental ability, as distinguished from cultural development, that exist between the racial elements of civilized countries. There is reason to believe that the more conspicuous temperamental traits that distinguish the

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Teutonic and Slavic from the Latin races are hereditary racial characteristics, although they may be modified to a certain degree by social environment. It may be maintained that conflicts will still be more apt to be won by nations of the highest endowment of intellect, and which by nature are best endowed with the instincts which make for loyalty and coöperation. But granting that this tendency exists, there are so many factors that modify its influence that its actual biological effect is much in doubt.

In the first place we must bear in mind that mere size is not infrequently the determining cause of victory quite regardless of the quality of the combatants. Fortunate alliances may bring success to an otherwise weak country. Geographical location often proves to be of importance in both offensive and defensive warfare. But of especial significance is a nation's cultural development which depends upon its past history and surroundings perhaps even more than the natural aptitudes of its people.

The Teutonic tribes fled before the well-drilled and equipped armies of the Romans, not because they were inferior either in mental or physical inheritance, but because they had lived outside of the main stream of European civilization, and when we observe the Serbians and Russians unable to cope with the well-organized and disciplined armies of Germany there is little ground for attributing the outcome to the innate superiority of the victors. The immediate causes of success were superior discipline, organization, equipment and the elaborate, scientific and detailed preparation for a long premeditated contingency. While we may admit that on the average and in the long run the success of a nation may be the result of superior hereditary endowments, it is probable that, as Schallmayer, Steinmetz and others have pointed out, the rôle of hereditary differences becomes less as civilization advances.

Granting that war is most apt to be won by the best stocks, its biological value depends upon the advantage that is taken of the victory. If winning a war does not lead to a greater expansion of the victorious people its racial value is nullified. As a result of warfare in recent times nations frequently lose territory, pay

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indemnities and suffer economic restrictions, but the people are left free to multiply and they frequently increase more rapidly than those of the victorious nation. The biologically defensible wars are wars of extermination, such as those carried on by the Dyaks and the Israelites. Wars for political purposes, and economic advantage, especially when they do not lead to the acquirement of new colonial regions in which to expand, often have little apparent effect on the biological fortunes of either party. The biological victory, such as it is, may often belong to the side which loses in battle. In future wars the successful nations may see to it that such a result will not follow. It would only be the part of consistency for those who justify war on the grounds of biological necessity to strive to convert future conflicts into wars of extermination. We have seen a tolerably close approximation to such a policy put into practice in the present great war. The widespread advocacy in Germany of the expropriation of the land of conquered nations, its settlement by Germans in order to increase the population and strength of the empire, and the banishment of the previous inhabitants or their reduction to hewers of wood and drawers of water should they prove sufficiently amenable, reveals a grim determination to use victory to the utmost for attaining the desired end. Professor H. G. Holle (*Polit.-Anthrop. Monatschr.*, 14, 1915) advises his countrymen: "If the national will to live, which has so gloriously manifested itself in the war, shall not yield to a culpable renunciation we must annex foreign dominions to the east and the west. . . . If we really come to make such dominions our own then such inhabitants, who on account of their race or characteristics are not adapted to us and upon whose gradual Germanization we cannot rely must be banished and their settlement must be imposed upon our opponents as a condition of peace. If we then credit the freed land, which is more valuable to us than gold, against the war indemnity thinly populated France would willingly accept this condition and gladly take over any of the Walloons who desired to be French. Also in regard to the Polish inhabitants of our present eastern boundary so far as they do not wish to remain German, the

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opportunity presents itself of offering them a double area in the 'Kingdom' of Poland." And the author quotes with approval a statement of Sontag (*Archiv für innere Kolonization*, 7, H. 5) "If the German empire needs new land adapted for settlement in order not to let its people stifle for want of room and in order greatly to increase the strength of its rural population, then indeed must we take this land if a war which we are compelled to enter upon offers us the opportunity. But—and this must be the foremost consideration in the matter—new land must be made free from a population which would detract from our national and political character, and which would only add new trouble to the difficulties already present in our eastern and western boundaries, and above all also the danger of a racial deterioration of the mass of our own people."

Victory, according to Holle and Sontag, must not be allowed to become sterile from the viewpoint of extending the race of the conquerors. The much fostered persuasion of racial superiority which appeals so powerfully to the German mind would have had in the event of victory no small share in determining the policy of the Germans in dealing with the peoples over whom they were victors. Other peoples are not to be regarded as having rights to be respected, but as so much human material of an inferior sort who, in the interests of biological evolution, should be supplanted by the superior blood of the Teutonic race. "A nation," says Klaus Wagner, "even when her national and fundamental interests do not coincide with those of another nation, still must rudely destroy this people's highest interests, must indeed remorselessly cut off from this foreign people the means of living for the future. It is a great powerful nation which overturns a less courageous and degenerate people and takes its territory from it. . . . The great nation needs new territory. Therefore it must spread out over foreign soil, and must displace strangers with the power of the sword."

We have lived past the day when war is waged as "a grand pastime."

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CHAPTER X

SEXUAL SELECTION, ASSORTATIVE MATING AND THE DIFFERENTIAL MARRIAGE RATE

"She's that sort," declared my Emma. "When you get them slim maidens, so quick-eared and quick-eyed as a mouse, with full lips that move and twinkle to their thoughts, and pretty, sly, sleepy eyes, same as Phillipa have got, then you can take it that men interest 'em more than any created thing. And they interest men, because nothin's so lightning quick as a man to answer that sort of a signal." Eden Phillpotts, *Chronicles of St. Tid.*

As is well known Mr. Darwin attempted to explain the development of many of the secondary sexual characters which distinguish the males from the females of higher animals as the result of the action of sexual selection. This term was used by Darwin to describe two very different kinds of selective activity; in one the outcome was based upon the "law of battle" or the struggle between rival males, the female falling as a matter of course to the lot of the victor; in the other mode of selection, the female is supposed to choose from among rival suitors the one whose charms make the strongest appeal. The law of battle is essentially a form of natural selection, although it does not as a rule result in the actual death of the unsuccessful contestant. It offers a very plausible explanation of the development of horns, tusks, greater strength and various offensive and defensive features that characterize the male sex of many animals. These endowments are directly useful in keeping the stock of their possessors, if not their possessors themselves, from extinction, and their development would naturally be favored by selection. But with sexual selection of the other type in which female volition forms an essential element, the outcome is usually the development of characteristics that charm the senses instead of directly aiding

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the male in meeting the hazards of battle. The brilliant plumage of male birds, their powers of song and their instincts for displaying their charms during courtship would probably long ago have been eliminated by natural selection had it not been for their appeal to the æsthetic appreciation of the females.

It is the part of Darwin's theory of sexual selection which implies the potency of female choice which has incurred the greatest amount of adverse criticism. It is undeniable that in man, who is the only creature we are directly concerned with at present, female selection is capable of operating much as Darwin supposed it to act among less highly developed animals. How far this fact suffices to account for the differences in the appearance of the two sexes is a difficult problem. Some of these, such as the greater size and strength of man, his broader shoulders and the greater development of his pugnacious instincts may be in part the result of the "law of battle" during the early stages of his evolution, though they may be in part also the outcome of struggles which had no direct relation to mating. That sexual selection in the sense of preferential mating has played any important part in producing the relatively hairless condition of the human body or the development of beards in the male sex is open to grave doubt. In fact, it would be hazardous to assert that any particular feature of either sex owes its existence wholly or even mainly to sexual selection. Nevertheless this factor can scarcely fail to have exerted some influence on racial development at all periods of human history. It is perhaps safe to say that unattractive women have always been at a discount, and that, notwithstanding their subordinate position among primitive peoples, women have in one way or another exercised a certain degree of choice in the selection of their mates. Undoubtedly the rigidity of tribal custom has greatly restricted the operation of sexual selection by women, and in many cases practically eliminated it altogether. Darwin, however, cites many illustrations of the fact that "with savages the women are not in quite so abject a state in relation to marriage as has often been supposed. They can tempt the men whom they prefer, and can sometimes reject those whom they

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dislike, either before or after marriage. Preference on the part of the women, steadily acting in any one direction, would ultimately affect the character of the tribe; for the women would generally choose not merely the handsomest men, but those who were at the same time best able to defend and support them. Such well-endowed pairs would commonly rear a larger number of offspring than the less favored. The same result would obviously follow in a still more marked manner if there was selection on both sides, that is, if the more attractive and powerful men were to prefer and were preferred by the more attractive women. And this double form of selection seems actually to have occurred, especially during the earlier periods of our long history."

Further evidence in the same direction is adduced by Westermarck who cites many illustrations that support his contention. "It would be a mistake," this author observes, "to suppose that, among the lower races, women are, as a rule, married without having any voice of their own in the matter. Their liberty of selection, on the contrary, is very considerable, and, however down-trodden, they well know how to make their influence felt" (*History of Human Marriage*, p. 212). Howard (*History of Matrimonial Institutions*, I, 216) states that "The facts appear to demonstrate that woman's original liberty of selection has never been entirely lost. It is evident that wife-purchase, though sometimes the means of degradation, even of marital bondage, is compatible with a high degree of matrimonial choice."

The evidence adduced by Darwin and Westermarck has been criticised by Finck who attempts to show that female choice has been so restricted by most uncivilized peoples that its influence is practically a negligible factor. It is true that with child betrothals, marriage by purchase, or capture, the force of parental authority, and the influence of custom, taboos, etc., woman is commonly disposed of with as little regard to her inclinations as if she were a cow or a sheep. Several recent studies of primitive peoples, however, have yielded considerable evidence that supports the conclusions of Darwin and Westermarck. If there has been a rather extensive period of our history in which female

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choice has been very greatly repressed this represents but a temporary phase of human evolution which was probably preceded, as we know it has been followed, by a period in which the female sex was allowed a greater freedom in the selection of mates.

The general effect of sexual selection among savages and semi-civilized peoples was, on the whole, probably eugenic; the men remaining unmated were apt to be the more unattractive or less valorous and enterprising members of the tribe, and the types that met with tribal approval, especially the successful warriors, often enjoyed especial facilities for transmitting their characteristics. While primitive women, like their more civilized sisters, were attracted by males who appealed to them as possessing beauty, they were probably more influenced by those qualities of strength and courage which led to supremacy in the "law of battle." The Indian maiden in a song quoted by Mr. Schoolcraft represents her lover as "tall and graceful as the young pine waving on the hill,—and as swift in his course as the noble stately deer. His hair is flowing and dark as the blackbird that floats through the air—And his eyes, like the eagle's, both piercing and bright—His heart it is fearless and great.—And his arm it is strong in the fight." In some tribes a man can win a wife only after making successful trials of strength and skill. "When a Dyak wants to marry," says Mr. Bock, "he must show himself a hero before he can gain favor with his intended." And this is commonly done by obtaining a number of heads from the members of a hostile tribe.

This predilection for strong and heroic men has long been a force making for the improvement of the race. It is not uncommon for a woman with or without her consent to be awarded as a prize to the males who are victors in the contest for her possession. "Sometimes," says Howard, "a fist-fight, a battle with clubs, a duel with bows and arrows or a pulling-match settles the claims of rival suitors; and often, as among the North American aborigines, the contest takes the form of wrestling for wives" (l. c., p. 203). It is a prevalent custom for chiefs who are apt to be men of uncommonly forcible type, to have several wives, and

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consequently many children. Where polygamy is permitted,—and it is a widely prevalent institution,—plural wives in general are apt to fall to the lot of the more enterprising and successful men.

Among primitive and semi-civilized peoples there is reason to believe that, both as a result of the law of battle and the exercise of female choice, the stronger and more virile men were, on the whole, more apt to transmit their qualities than under our present civilized régime. Progress inevitably introduces many changes in the way in which sexual selection operates. In attempting to estimate how sexual selection has been affected by our modern civilization it must be borne in mind that we have to reckon with various tendencies which may work to produce opposed, or at least different results. As common observation shows, chances for marriage are considerably reduced among the conspicuously ugly. Those with morose and unsocial dispositions are not so apt to attract mates as the cheerful and vivacious. The sexually attractive have an advantage over the sexually unattractive. Vitality, both in predisposing to marriage and in rendering its possessors more acceptable to the other sex, is a quality distinctly favored by sexual as well as by natural selection. Although in marriage there is fortunately a wide variation in matters of taste, there is nevertheless a broad basis of agreement upon the peculiarities of the opposite sex that are most alluring. Qualities that make a peculiar appeal to the other sex are those which in general are the index of characteristics of racial value. As Havelock Ellis remarks "in most countries an important and essential element of beauty lies in the emphasis of the secondary and tertiary sexual characters; the special character of the hair in woman, her breasts, her lips, and innumerable other qualities of minor saliency, but all apt to be of significance from the point of view of sexual selection." The instinctive proclivity of man to select characteristics which are the outward and visible signs of qualities of importance in the perpetuation of the species has doubtless long been a factor of importance in racial evolution and will continue to be so long as human nature remains as it is.

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The qualities which are prized in mates, and which, therefore, tend to be developed by sexual selection, may be ascertained without much difficulty by collecting statements of preferences from a sufficiently large number of people to give a representative expression of prevalent taste. The magazine, *Physical Culture*, has collected expressions of opinion from its women readers as to the qualities desired in an ideal husband. The first requisite was health; financial success, paternity, appearance, disposition, education, character, housekeeping and dress followed in the order named. The results of a similar inquiry addressed to its male readers regarding the qualities desired in an ideal wife may be tabulated as follows:

Requirements of an Ideal Wife According to Male Readers of Physical Culture

Qualities	*Per cent*
Health	23
Looks	14
Housekeeping	12
Disposition	11
Maternity	11
Education	10
Management	7
Dress	7
Character	5

The classification of qualities was somewhat unfortunate and probably accounts for the small value apparently placed on character. A statement of the matrimonial requirements of 115 young women of the Brigham Young College, a Mormon institution of Utah, showed that 86 per cent demanded that the prospective husband must be morally pure; 99 per cent required that he be mentally and physically strong, 52 per cent that he be of the same religion as themselves, 45 per cent that he must be taller than they, and 93 per cent that he must not smoke, chew or drink, thereby voicing a pronounced difference of opinion from that of Robert Louis Stevenson who declared that "no woman

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should marry a teetotaler, or a man who does not smoke." The judgments of these young ladies are interesting as indicating how far ideals of manhood may be moulded by instruction and afford ground for hope that much may be accomplished in the direction of eugenic improvement by inculcating the proper standards in the minds of the young.

The potency of the appreciation of beauty and ability in the choice of mates is indicated by the study of Miss C. F. Gilmore on the marriages of the graduates of the Southwestern State Normal School of Pennsylvania. The girls were graded for beauty by impartial observers on the scale of 100. Those of grade 80 and over had the highest marriage rate, while among the others the marriage rate in general declined in proportion as the grade for beauty was low. In the same school the girls of higher standing were most chosen. There was a slight tendency for the marriage rate to decrease with lower scholastic standing, although the girls graded between 60 and 70 were married some what more rapidly than the class between 70 and 80. How far these results find a parallel elsewhere we have too little data to ascertain. It is, *a priori*, probable and in accord with common observation that the most beautiful girls are apt to be chosen as wives. Intellect in women may be preferred in general, notwithstanding the fact that many men set little store by this quality in the other sex, and may even prefer an amiable sort of stupidity in their wives so that they can enjoy a sense of their own mental superiority. But quite aside from the attractiveness of intellect there is a tendency for the more intellectual women to choose a celibate career for various reasons that have been mentioned elsewhere. Intellect influences marriage selection in two diverse ways; first, by rendering the prospective partners more attractive, and second, by making its possessors more independent and particular in the choice of a mate, or, through affording other interests, diminishing the inclination toward married life. Intellect in men tends to be selected by women, and intellectual men are not as a class markedly indisposed to marry. However, they tend to marry relatively late in life, and the effect of this on

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the race is the same as if they were chosen with relative infrequency.

Sexual selection in the strict Darwinian sense has been distinguished by Pearson from another form of selection which is termed assortative mating. The former he designates as preferential mating. "If we wish to discuss," he says, "whether preferential mating with regard to any organ or character is taking place in a given form of life, we must investigate whether the type and variability of the mated and unmated members of one or the other sex are the same. If they are not, then sexual selection in the form of preferential mating is undoubtedly at work." Pearson has shown us from data collected by Francis Galton that light-eyed people marry more frequently than dark-eyed. There is thus a preferential mating in man. "Whether the preference arises from greater sex instincts or from the æsthetic sense is immaterial from the standpoint of evolution, however interesting from the moral or social standpoint."

Assortative mating is the union of like with like. It may occur where the mated and the unmated do not differ in the average development of any characteristic, or where all the individuals become mated. The few studies of assortative mating in man have shown, contrary to popular impression, that there is a tendency of persons of like characteristics to marry. Fol by a study of 251 photographs of young and old married couples concluded that in the majority of cases (66.7 per cent in the young and 71.7 per cent in the old) the parties were similar instead of dissimilar. Galton's early studies (*Natural Inheritance*) failed to show that people were much influenced in marriage by similarities in stature, temper and artistic tastes. The mating of couples with similar eye color was somewhat more frequent than would be produced through mere chance unions. In his later studies of the parents of English men of science Galton showed that in temperament and color of eyes and hair the parents showed a notable similarity. From more extensive data Pearson has shown that light-eyed men tend to marry light-eyed women more than dark-eyed, and that dark-eyed men tend to marry

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dark-eyed women more than light-eyed. In stature the tendency to assortative mating was marked; the tall tend to marry with tall, the short with short, and the intermediate with intermediate. H. Ellis has added confirmatory evidence of assortative mating of people of similar stature. He found that people tend to marry those similar to themselves in complexion, although the number of cases considered was too small to base a positive conclusion upon. There is evidence that the tuberculous tend to marry the tuberculous, due in part probably to the influences that bring them together in the same localities, and in part to a natural sympathy which draws them together, and also to the fact that they are less liable to be chosen by normal and healthy persons. That the deaf tend to marry the deaf, as has been shown by Fay and Bell, is due largely to the segregation of these people in institutions, although the two other causes we have just mentioned may also be influential upon those who remain scattered among the general population.

One of the most unfortunate kinds of assortative mating in man, as has been pointed out in a previous chapter, is the unusual frequency of marriages among the feeble-minded and degenerate. The unattractive physical and temperamental qualities which would be a bar to mating among people of higher grade are not so potent a deterrent to matrimony or at least to a union of the sexes among inferior stocks. What data have been collected on the proportion of married people of marriageable age among the Jukes indicate that there are relatively more of them married than among people in general. In this family as in the Kallikaks, Zeroes, Nams, and Hill Folk early marriages were customary. Of the Hill Folk Danielson and Davenport remark that, "The large majority of the matings which are represented in this report are of defectives with defectives. A few of those who have drifted into a different part of the country have married persons of a higher degree of intelligence, but the most of such wanderers have, even in a new location, found mates who were about their equal in intelligence and ambition." This condition is typical of similar families.

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Passing to people of a higher grade it may be said that mediocrity tends to mate with mediocrity and that superior types tend to select their mates among the superior. Common standards, agreement in tastes and similar educational attainments, doubtless have a marked effect in bringing about unions between those of similar inherent endowments. By thus limiting marriages to certain castes assortative mating tends to bring about the differentiation of the race into a number of divergent stocks. Whether it conduces to racial advance or the reverse depends upon various accessory circumstances. *Per se* it is a condition of divergence rather than racial improvement. Naturally the character of the race would be very markedly affected by variations in the frequency of age of marriage in the castes which assortative mating tends to create. Among the intellectual classes, while we meet with the tendency of like to mate with like, we find the frequency of marriage much reduced, and the age of marriage increased. Data previously cited in the discussion of differential fecundity indicate a lamentably low marriage rate among college women. This is probably due to several causes, among which may be mentioned the higher qualifications which the college woman demands of the man she marries, her greater financial independence, and therefore the less temptation to marry for support; and to some extent, as some writers have pointed out, the fact that unattractive women may be more apt to go to college than their more favored sisters. While some may take a college course because they do not marry or are not likely to marry, I think that most people connected with educational institutions for several years will agree that the proportion of this class has materially diminished in the last two decades.

The situation revealed by Miss H. D. Murphy's study of the women of Washington Seminary is typical. The decrease of marriage rates and the increase of careers other than home making which women follow are shown in the following table:

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Proportions of Graduates who Marry

(From Popenoe and Johnson's *Applied Eugenics*)

Decade of graduation	'45	'55	'65	'75	'85	'95	'00
Per cent married	78	74	67	72	59	57	55
Per cent not in home-making occupations	20	13	12	11	30	30	39

Miss Shinn (*Century*, Oct., 1895) gives the following data on the marriage rates of college women assuming graduation at the average age of 22:

Marriage Rates of College Graduates.

Age	*Coeducated*	*Separate*
25	38.1	29.6
30	49.9	40.1
35	53.6	46.6
40	56.9	51.8

It may be said that about 50 per cent of college women remain unmarried. It is apparently true that women of superior intellect and force of character are those who, whether college women or not, are pretty apt to be selected for spinsterhood. They are more likely to win positions which permit them to enjoy the comforts and many of the luxuries of life; they develop other interests which often detract from the appeal to matrimony. In some cases they lose a certain feminine charm, a misfortune that arouses a deep-seated instinctive recoil in the opposite sex. There can be no doubt that the race is losing a vast wealth of material for motherhood of the best and most efficient type. Many of the women who are nowadays most prone to sacrifice motherhood to a "career" are just the ones upon whom the obligation of motherhood should rest with the greatest weight. It may be seriously doubted if the growing independence of women, despite its many advantages, has proven an unmixed blessing. Thus far it has worked to deteriorate the race in the interests of social advancement, a process which is bound to be disastrous in the long run.

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That the marriage rate and the average age of marriage vary considerably according to the social and economic status is a fact the racial influence of which naturally depends upon what degree of correlation exists between the social and economic position of different classes and their heritable qualities. Those who believe that there is no such correlation or that it is insignificant in amount will consider that it makes little difference so far as the innate qualities of the race are concerned how marriage rates or birth rates are distributed among the different classes of the population. There is much reason to believe, as I have already contended, that the inherited endowments of human beings constitute, in the long run, a potent factor in determining the place they occupy in our social organization, and if this is true, the marriage rates of different classes becomes a matter of much interest in regard to our biological development. Bertillon has furnished some data on the relation between the marriage rate and economic status in Paris, Berlin and Vienna. These are presented in the following table which gives the number of marriages per 1,000 of unmarried men of over 20 and of women of over 15 years of age:

Urban Marriage Rates According to Economic Status

Character of District	*Paris 1886–95*	*Berlin 1886–95*	*Vienna 1891-97*	
			Men	*Women*
Very poor	29.1	44.0	90.1	67.0
Poor	27.9	44.4	80.6	52.7
Well off	24.7	36.3	84.0	48.9
Very well off	24.5	26.5	71.6	40.7
Rich	21.0	26.0	56.6	28.7
Very rich	21.1	20.5	43.4	19.1

For several reasons this table constitutes only a rough approximation to the true relation between marriage and economic

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status, but the general tendency it exhibits is in harmony with much other evidence.

The average ages of the first marriage in different classes in Copenhagen for the years 1878–1882 are given by Rubin and Westergaard as follows:

Age of Marriage According to Occupation in Copenhagen

	Men	*Women*
Officials, Merchants	32.2	26.5
Artizans, Shopkeepers	31.2	27.6
Teachers	29.7	26.5
Lower Officials	28.0	26.8
Laborers	27.5	26.8

The diverse tendencies exhibited in sexual selection among human beings render it difficult to estimate the nature of its influence. There has been no comprehensive study in any community of the eugenic worth of those who marry as compared with those who do not marry. Such a study in several communities of different social and economic levels would doubtless yield results of much interest and value. We know that many persons remain unmarried on account of various forms of congenital inferiority or defect both in mind and body. It is probable that a much larger proportion of our population are coming to remain unmarried because they wish to be economically independent, or free to follow their own lines of interest, or because their ideals of a life partner are so high that they have never found the person whom they would consent to marry. Are the fine types of humanity who now remain single compensated for by those whose natural inferiority or undesirability prevents them from marrying? There is little evidence that such is the case. At present it is very doubtful if the net result of sexual selection is in the direction of racial improvement.[1]

[1] "The marrying class is nowadays the class that lacks the physiological qual-

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But whatever may be its present shortcomings sexual selection is an evolutionary factor of magnificent possibilities. It affords perhaps the readiest method for a group to realize its eugenic ideals. Alfred Russell Wallace believes that when economic reforms do away with the present temptation for women to marry in order to secure subsistence and a home the standard of marriage selection will be greatly raised. "The idle or the utterly selfish would be almost universally rejected; the chronically diseased or the weak in intellect would also usually remain unmarried, at least till an advanced period of life, while those who showed any tendency to insanity or exhibited any congenital deformity would also be rejected by the younger women, because it would be considered an offense against society to be the means of perpetuating any such diseases or imperfections." Women, Wallace contends, are now driven to marry "men who are palpably unjust, stupid or weak," and that "it may be taken as certain, therefore, than when women are economically and socially free to choose, numbers of the worst men among all classes who now readily obtain wives *will be almost certainly rejected.*"

One would like to be able to share Wallace's sanguine hopes of the eugenic potency of economic reform. Perhaps his chivalrous championship of oppressed woman has prevented him from giving due weight to the existence of the idle, worthless and selfish members of the weaker sex who, in an improved economic régime, would probably find no greater difficulty than they do at present in attaching themselves to some unfortunate male. Both the worthless and the worthy tend to mate with their own kind, and they would doubtless continue to do so under any economic system that could be devised. It is not so much economic reform *per se* that would improve marriage selection, as the greater diffusion of education, and the elevation of the ethical standards of the mass of the people. The amelioration of economic abuses

ifications for parentage. The better-paid, well-nourished, provident artizans are marrying later in life, and producing fewer offspring than the slum natives. Professional men, doctors, solicitors, clergymen, authors, artists, teachers and brain-workers are forced in large numbers to defer wedlock till middle age, or even later." Gallichan, *The Great Unmarried*, p. 41.

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might facilitate greatly the attainment of this goal, but it would take much more than economic reform to bring about the change in our outlook and ideals that would be required to inaugurate a greatly improved type of sexual selection.

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CHAPTER XI

CONSANGUINEOUS MARRIAGES AND MISCEGENATION

"We are coming honestly to believe that the world is richer for the existence both of other civilizations and of other racial types than our own. . . . Even if we look at the future of the species as a matter of pure biology, we are warned by men of science that it is not safe to depend only on one family or one variety for the whole breeding-stock of the world. For the moment we shrink from the interbreeding of races, but we do so in spite of some conspicuous examples of successful interbreeding in the past, and largely because of our complete ignorance of the conditions on which success depends."—Graham Wallas, *Human Nature and Politics*, pp. 293, 294.

THE peoples of the earth have followed the most varied customs in regard to marriage. From extreme inbreeding we have all gradations to the crossing of distinct races. Among savage and barbarous peoples the practice of exogamy, or marriage outside the tribe, is very prevalent. In general, we find that marriages between near relatives are forbidden, and often the prohibition goes farther and includes those bearing the same name or belonging to a group which may be specified in various other ways. Such prohibitions are not due to any instinctive repugnance to incest,—certainly no such instinct occurs in the lower animals,—nor is it reasonable to suppose, as has sometimes been done, that they arose from the observed ill effects of consanguineous unions. The effect of marriages among near kin is a matter about which qualified students of genetics have come to different opinions, and it is hardly probable that primitive peoples have been able to arrive at valid conclusions on a subject that requires for its solution a refinement of inductive method which is quite alien to the thinking of untrained men.

Among plants and animals the effects of inbreeding and cross breeding have long attracted the attention of breeders. The

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subject enlisted the interest of Mr. Darwin who devoted to it several years of study. By an extensive series of well-planned and controlled experiments Darwin showed that in many plants continued inbreeding was followed by a reduction of the size, vigor and fertility of the stock, and that crosses with related varieties often led to the production of forms with greater vigor than either of the parents. In fact, many plants were found to be sterile when fertilized with their own pollen, although others, such as beans, are regularly self-pollinated. The numerous mechanical and other devices by means of which plants effect cross fertilization, were interpreted as adaptations developed by natural selection for securing the advantages which crossing was supposed to confer. "Nature," says Darwin, "abhors perpetual self-fertilization."

Among animals, cross fertilization is more common than in plants. Male and female sex organs are more frequently borne by separate individuals, but even where hermaphroditism exists, it is an exceedingly rare occurrence for eggs to be fertilized by sperm cells from the same animal. With the exception of some of the Protozoa, we do not meet with that close inbreeding which is found in a considerable number of species of plants.

"When," says Darwin, "we consider the various facts now given which plainly show that good follows from crossing, and less plainly that evil follows from close interbreeding, and when we bear in mind that throughout the organic world elaborate provision has been made for the occasional union of distinct individuals, the evidence of a great law of nature is, if not proved, at least rendered in the highest degree probable; namely, that the crossing of animals and plants which are not closely related to each other is highly beneficial or even necessary, and that interbreeding prolonged during many generations is highly injurious."

When we observe the inbreeding of plants and animals we cannot fail to be impressed by the varied results which are found in different forms. In many plants continued self-pollination is followed by rapid deterioration. Shull and also East and Hayes in experimenting with inbred varieties of corn found that there

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was a general decrease of productivity in successive generations. When two deteriorated inbred strains were crossed the yield was generally markedly increased. In order to insure the greatest production in corn it is necessary to use seed that results from the crossing of different strains.

In tobaccos which are commonly self-pollinated the effects of crossing are much more variable. In the cross between *Nicotiana tabacum* and *N. sylvestris* East and Hayes found that the F_1 hybrids were superior to the parents in height, vigor and profusion of flowers, although they were sterile. Crosses between some tobaccos resulted in small, weak plants, and crosses between others were entirely without result. In fact the tobaccos present almost every gradation between negative results and a greatly enhanced vigor of progeny.

There are many plants, such as our garden peas and beans, in which the opportunity for self-pollination is normally excluded, which propagate indefinitely without deterioration. Others reproduce parthenogenetically or propagate by purely vegetative methods without any apparent loss of vigor. In such species crosses may produce plants of increased size and sometimes greater fertility, or the reverse, according to the particular kinds used. While it is a very general fact that crossing of related varieties produces superior types, the rule is very far from being a universal law.

Most breeders of animals have held that close inbreeding, while of value for the preservation or the enhancement of desired qualities, tends to produce a deterioration of the stock. The experiments of Crampe, Ritzima Bos, Weismann, von Guaita and Fabre-Domengue afforded support to the commonly accepted opinions of the practical breeder. These results, however, should be accepted with caution in the light of more recent investigations.

The work of Castle and his pupils on the fruit fly Drosophila showed that brother and sister matings could be carried on for 59 generations without loss of fertility, although the crossing of two inbred strains produced a more fertile progeny. Moenkhaus found that within a closely inbred strain of Drosophila,

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fertility could be increased as well as decreased by selective breeding. Some of the lines were inbred (brother and sister) for 75 generations without loss of fertility or vigor. The work of Shultze and of Copeman and Parsons on mice, of Castle on rats (bred for 17 generations), and the observations on guinea pigs reported by Popenoe revealed no evidence of a decline of fertility as a result of inbreeding.

The most thorough investigation of inbreeding has been carried on by Miss H. D. King with the albino rat. The work of Miss King revealed several sources of error that have to be guarded against in a study of inbreeding and which not improbably misled some previous investigators of the subject. Without describing the methods and precautions followed by Miss King, it may be stated that 25 generations of such close inbreeding as brother and sister matings did not produce any loss in the vigor, growth, or fertility of the inbred strains as compared with the controls.

The rediscovery of Mendel's law in 1900 stimulated renewed interest in the problems of inbreeding and cross breeding, and led to attempts to interpret the varied results in terms of this illuminating principle. The usual explanation given is that inbreeding is injurious only when it brings out unfavorable characteristics that have been latent in the stock. Naturally, inbreeding affords an opportunity for recessive characters to make their appearance. If, for instance, such a recessive trait as albinism is present in a stock, it may be brought out by inbreeding. Davenport remarks that "Albino communities of which there are several in the United States are inbred communities, but not all inbred communities contain albinos."

Many strains contain recessive characteristics of an undesirable kind. So long as these are kept from appearing by the presence of corresponding dominant characteristics all goes well. But when two organisms are crossed in each of which the recessive trait occurs, we should expect the trait to appear in one-fourth of the offspring. In the different varieties of corn there are probably many factors upon which size, vigor and fertility depend. Most

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recessive factors, are prevented from becoming manifest owing to the cross pollination that usually occurs. When self-fertilization takes place these recessive factors have an opportunity to find expression. With continued self-fertilization the strain becomes homozygous for more and more factors, until finally a condition is reached with complete homozygosis in which no further deterioration results. In corn much more deterioration occurs in some varieties than in others. This is what one would expect according to the Mendelian interpretation, inasmuch as the characters for which the strain comes to be homozygous would vary in different cases.[1]

Inbreeding in forms containing no recessive factors that make for reduced vigor would, according to this interpretation, produce no ill effects. Inbreeding does not cause defect; it simply brings out latent defect when it occurs in both parents. Whether or not inbreeding is followed by inferior progeny depends, therefore, upon the composition of the germ plasm of the inbred stock. If the stock is good it not only produces no degeneracy, but affords a means of perpetuating valuable qualities, and it becomes especially useful when the desired qualities are recessive.

The usual Mendelian interpretation of the results of inbreeding and cross breeding which has been briefly outlined affords a plausible explanation, so far as it goes, of the diverse results obtained, and is supported by other lines of evidence which we shall not here attempt to discuss.

[1] Keeble and Pellew have attempted to explain the fact that heterozygosis is commonly associated with increased vigor, by assuming that there are more dominant factors present in the heterozygous state. The results of heterozygosis are doubtless dependent not merely on the number of different factors present, but upon their quality and the nature of their interactions. If recent investigations throw doubt on the doctrine of senescence and the theory of rejuvenescence, several problems in regard to inbreeding and cross breeding still remain obscure. From the standpoint of vigor and fertility we can only say that some crosses are good, some are bad and others indifferent. While Mendel's law may have brought us nearer the explanation of why these diverse results occur, the final solution of the problem must await further research. See also the discussions of this topic in East and Jones' *Inbreeding and Outbreeding* (Phila., 1919) which appeared after the above was written.

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In the light of what is known of the effects of inbreeding and cross breeding in plants and animals it is obvious that we are not in a position to draw conclusions *a priori* in regard to inbreeding and cross breeding in man. In the absence of direct observations on the effect of crossing of any two races of human beings, we might expect as a probable result that, in regard to general vigor, (1) the progeny would be superior to both parents, (2) that they would be inferior to both, (3) that they would be superior to the one and inferior to the other, or (4) that they would be on the same general level as either one. We might predict with some assurance what would be the probable outcome as to the inheritance of eye color, hair color and some other characters whose mode of transmission has been studied in other cases. But concerning most of the qualities that render one race superior to another we should be justified in making only very guarded suppositions.

The results of inbreeding and cross breeding in man present a general similarity to those observed in plants and animals. They may reasonably be interpreted according to the Mendelian scheme, although this circumstance might not enable us to say whether, in general, they are desirable or the reverse. In regard to the effect of consanguineous marriages especially, there has accumulated a large number of observations. It is an undoubted fact that such matings have frequently been followed by the appearance of undesirable characteristics in the offspring. But in weighing the evidence on this point one has to guard against being unduly impressed by facts which have been especially selected to support a particular thesis. Numerous cases have been reported in which various defects have been associated with consanguineous matings. It would be possible, however, to amass many instances of this kind even if consanguinity had nothing to do with the production of defect. With this caveat in mind let us consider this possible influence of consanguinity in bringing to light certain hereditary traits.

The rôle of consanguinity in bringing forth feeble-minded offspring has been discussed by many authors who have reported

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most diverse results. Huth has compiled the following table from several writers who have given the percentage of consanguinity among the parents of idiotic offspring:

Feeble-Minded Offspring from Consanguineous Marriages

Observers	*Total No. of Feeble-Minded Cases*	*No. Derived for Consanguineous Marriage*	*Percentage*
Gralhaus.....	1,388	53	3.8
Howe.....	359	17 (or 20)	4.7 (or 5.5)
Down.....	852	60	7.0
Ireland.....	213	18	8.5
Comm. of Conn.....	160	20	12.5
Bemiss.....			15.0
Mitchell.....	519	98	18.1

The fluctuations in these data do not prove the contention of Huth that the statistics are entirely worthless. They are what one would expect in the light of Mendelian theory. And there is nothing surprising in the results obtained by Dr. Voisin who found, as the result of a careful examination of 1,077 of his patients at Bicêtre and Saltpêtreière, that in no one instance could healthy consanguinity be regarded as a cause of idiocy, epilepsy or insanity. The same observer reports on an isolated community at Batz in which there were five cousin marriages and 31 second cousin marriages with no malformations or mental defects. Howe, on the other hand, found among the parents of 359 idiots, 17 and possibly 20 cases of consanguineous marriages. These consanguineous parents, several of whom were scrofulous and intemperate, produced 95 children "of whom 44 were idiotic, 12 others were scrofulous, 1 was dead and 1 was a dwarf." The percentage of idiots given in the table as the findings of Bemiss rests upon an inference not very well supported by the facts. Out of 833 consanguineous marriages he found that 7.8 per cent

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of the children were feeble-minded, while out of 125 ordinary marriages the feeble-minded children were only 0.7 per cent.

Consanguineous marriages were found by Estabrook and Davenport to constitute nearly a quarter of all the matings of the Nam family. Many of the inbred lines of this notorious stock produced a high percentage of feeble-minded offspring. The same is true of the Kallikaks and other families with a large amount of mental defect. It is undeniable that in such cases the marriage of relatives is apt to produce unfortunate results.

The rôle of consanguinity in the production of deaf-mutism has been studied especially by Fay and Bell. The precise mode of transmission of congenital deafness is not known. It is apparently recessive, but nevertheless the marriage of two congenital deaf mutes produces only about 25 per cent, instead of 100 per cent, of deaf offspring. This may be at least formally explained by assuming that deafness is often the result of different factors in different strains. Fay found that marriages of deaf mute relatives produced 30 per cent of deaf offspring, and that 45 per cent of the matings produced at least one deaf child. Bell on the basis of the U. S. census returns estimates that "of the 2,527 deaf whose parents were cousins, 632, or 25 per cent, are congenitally deaf, of whom 350 or 55.41 per cent also have deaf relatives of the classes specified; while among the 53,980 whose parents were not so related the number of congenitally deaf is 3,666 or but 6.8 per cent, of whom only 1,023, or 27.9 per cent have deaf relatives."[1]

As Davenport states "If one partner be congenitally deaf and the other have no ear defect and knows none in his family the chances for deaf offspring are small. In 72 such marriages considered by Fay only 5 resulted in deaf offspring. It is quite likely

[1] For an interesting attempt to interpret congenital deafness as a simple Mendelian character see H. Lundborg, Ueber die Erblichkeitsverhältnisse der konstitutionellen (hereditären) Taubstummheit. Arch. f. Rass. Ges. Biol. 9, 133–149, 1912. Further discussion by the same author will be found in the new journal *Hereditas*, Vol. 1, 35–40, 1920. See also Bergh, E. Studier över dövstumheten i Malmöhus län. M. D. thesis, Stockholm, 1919.

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that in some even of these five matings the normal parent had unknown deaf relatives. But if the hearing partner have deaf relatives then the proportion of resulting fraternities containing deaf mutes increases to 35 per cent."

Huth who has made a very useful compilation of data on the subject has tabulated returns from 52 institutions or observers with percentages of deaf mutes of consanguineous origin varying from 0 to 34.4, but with a general average of over 5 per cent in 33 cases, of 10 per cent or over in 21 cases, and 25 per cent or over in 6 cases. Although the variability of these results was used as an argument against the rôle of consanguineous marriages *per se* in the production of deafness, the data show that this defect arises from such marriages in an unusually large number of instances.

The problem of the inheritance of deaf-mutism, like that of the transmission of feeble-mindedness, epilepsy and insanity, is complicated by the as yet insufficiently known influence of syphilis. Dr. Kerr Love has attempted to separate cases of syphilitic origin by the use of the Wassermann reaction. It is only by eliminating such cases, as well as those caused early in life, that the real mode by which deafness is transmitted can be revealed.

Where people form inbreeding communities different traits are apt to become prevalent in different localities. According to Davenport, "consanguinity on Martha's Vineyard results in 11 per cent deaf mutes and a number of hermaphrodites; in Point Judith in 13 per cent idiocy and 7 per cent insanity; in an island off the Maine Coast the consequence is intellectual dullness; in Block Island loss of fecundity; in some of the 'Banks' off the coast of North Carolina, suspiciousness, and an inability to pass beyond the third or fourth grade of school; in a peninsula on the east coast of Chesapeake Bay the defect is dwarfness of stature; in George Island and Abaco (Bahama Islands) it is idiocy and blindness (G. A. Penrose, 1905). There is no one trait that results from the marriage of kin; the result is determined by the specific defect in the germ plasm of the common ancestor."

Such evils of inbreeding as have been discussed may be re-

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garded as the inevitable consequence of Mendel's law of inheritance. Where a defect is inherited by two parents from a common ancestor their union is naturally followed by the production of the defect in question. It may be seriously doubted if inbreeding does more than this or is ever strictly speaking the cause of defect of any kind; it simply makes manifest defects that are already in the germ plasm.

It must not be forgotten that if inbreeding sometimes brings out undesirable qualities it may also conserve good ones. A conspicuous example of a consanguineous marriage which was productive of most fortunate results is afforded by the marriage of Charles Darwin with his first cousin, Emma Wedgewood. The Wedgewoods, like the Darwins, belonged to a noteworthy family. Josiah Wedgewood the founder of the works that make the well-known Wedgewood pottery was a F. R. S. as was also the celebrated Erasmus Darwin. All of Darwin's sons became celebrated for their intellectual achievements and are noteworthy for being unusually able and normal types of men.

A good deal of close intermarrying has occurred in the Walcotts, Edwards, and other old New England families who have produced many of our most able men. Consanguineous marriages have probably been a means of conserving superior ability in some of the royal families of Europe, although in others they have served to bring out a neuropathic inheritance.[1]

The effect of crosses between different races and peoples has been the subject of no end of discussion. Naturalists, historians, anthropologists, travelers, missionaries, and casual observers of all descriptions have contributed to swell the volume of literature which has been accumulating on this subject since the days of the author of Leviticus. Even the most competent observers have come to opposed conclusions, and it is not rare to find the same mongrel race spoken of by different writers in quite contradictory terms. No one can read much of the literature on race crossing

[1] That cousin marriages in England are no more harmful than ordinary marriages is indicated by the statistical investigations of George Darwin (Jour. Roy. Stat. Soc. 38, 153–182, 1875.)

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without being impressed with the fact that prejudice and preconceived opinions have greatly influenced the verdict of a large proportion of those who have dealt with the problem. It is no easy matter in most cases to distinguish the effects of race crossing *per se* from the influence of the social environment under which the cross breed lives. The product of race mixture is very frequently a person of unsettled social status. He is more or less alienated from both races from which he sprang. His associations are only too frequently with the worst elements of the more cultivated stock. The family environment and traditions under which he is brought up are often less favorable than they are for the offspring of either pure race. Contact between whites and natives has effected the debauchery of the native women, increased addiction to alcohol, and the introduction of tubuculosis and other diseases which are apt to be especially severe upon the inferior race. The spread of venereal diseases with the most deplorable influence upon the native and mixed population is an occurrence which has been repeated almost times without number wherever civilized man has mingled with more primitive peoples. Where race mixture occurs old customs which form the chief restraining influence on conduct become broken up; tribal feeling and character are weakened, and moral laxity naturally follows.

The saddest pages of history are those which deal with the relations of the white man with his less enlightened brethren. The whites may have introduced missionaries, salvation, and a measure of education, but they have also brought syphilis, debauchery, industrial slavery and not infrequently extinction.

There can be little doubt that the shortcomings frequently attributed to mongrel stocks are the result of causes quite independent of heredity. Nevertheless, nothing is more common than to find the defects and vices as well as the virtues of mixed races attributed to the influence of race mixture *per se*. An opinion on race mixture which is frequently appealed to is that of Prof. Agassiz who says, in speaking of the mixed population of Brazil, "Let any one who doubts the evil of this mixture of races, and is inclined from mistaken philanthropy to break down all

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barriers between them, come to Brazil. He cannot deny the deterioration consequent upon the amalgamation of races, more wide spread here than in any country in the world, and which is rapidly effacing the best qualities of the white man, the negro, and the Indian, leaving a mongrel, nondescript type, deficient in physical and mental energy."

Schultz in speaking of race mixture in Peru says, "The degeneration there is even greater and has been more rapid than in the other South American countries and the cause is the infusion of Chinese blood into the veins of the white-negro-Indian compound. There are scarcely any Indo-Europeans of pure blood in Peru, for with the exception of pure Indians in the interior the population consists of mestizos, Zambos, mulattoes, terceroons, quadroons, cholos, musties, fusties and dusties; crosses between Spaniards and Indians, Spaniards and negroes, Spaniards and yellows; crosses between these people and the cholos, musties and dusties; crosses between mongrels of one kind and mongrels of other kinds. All kinds of cross breeds infest the land. The result is incredible rottenness." In all the great South American melting pot and also in Mexico and Central America we meet with much the same situation.

Schultz's book (*Race or Mongrel?*) is a plea for racial purity. The downfall of nations which has been explained in so many different ways is accounted for in this volume as a result of hybridization. Greeks, Romans, Hindoos, Egyptians and Lombards have all been destroyed by the admixture of foreign blood. "Nature suffers no mongrel to live." Only the pure races thrive and attain a high degree of development.

Lapouge speaking of race crosses tells us that "En general, les résultats de ces unions n'ont rien d'avantageux. Laideur, vulgarité, manque de vigueur, moindre durée de vie, tares physiques nombreuses, nos sang-mêlés ont tout contre eux." Mr. Madison Grant in a recent work (*The Passing of the Great Race*) which has attracted considerable attention, represents the racial hybrid as no higher than the lower race from which he sprang. "The cross between a white man and an Indian is an Indian;

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the cross between a white man and a negro is a negro, the cross between a white man and a Hindu is a Hindu, and the cross between any of the three European races and a Jew is a Jew."

The unfortunate cross breed has come in for condemnation from all quarters. The favorite description is that the mongrel inherits the vices of both parents and the virtues of neither. According to Schultz, it is according to a "law of nature,"—although why it is so is inexplicable,—that "only the bad qualities of the whites and the negro are transmitted to the mongrel offspring." Certainly the results of hybridization in plants and animals are very far from proving Schultz's thesis. And it is rather surprising that a writer who appeals to biology as affording a support to his views on race mixture should have ignored so much that fails to corroborate his theory. It is nonsense to say that the inferiority of the hybrid exemplifies a law of nature. There are abundant plant and animal hybrids that are superior types, and biology affords no *a priori* reason why the hybrids of races and peoples may not be superior also. We can only decide the question by an impartial appeal to the results of race crossing, after making due allowance for the social and other influences which may affect the character of the mixed stock.

That mongrel nations are often decadent is not an infallible proof that biologically or psychologically the effect of race crossing is bad. Mr. James Bryce states in his work on *South America*, —a work which, by the way, gives a verdict quite different from that of Schultz on the mixed people of that country,—"No one has yet studied scientifically the results of race fusion. History throws little light on the subject, because wherever there has been a mixture of races there have been also concomitant circumstances influencing the people who are the product of the mixture which have made it hard to determine whether the deterioration (or improvement) is due to this or some other cause."

Mr. Bryce is no apologist for miscegenation and he has elsewhere warned the American people of the danger of absorbing the blood of the negro. Race crossing may have unfortunate social consequences without being bad biologically. As Topinard has

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contended, the crosses of related peoples or races may be advantageous, while the union of the more distinct races, such as white and negro, may result in a very undesirable product. This is quite possible if not probable, and has the support of numerous analogies among plants and animals. But it would be possible to support almost any conclusion on race crossing by an appeal to such analogies. Those who condemn race mixtures point to the inferiority of many mongrel breeds and the infertility of crosses between distantly related stocks, while the advocates of miscegenation refer to the benefits that have so often resulted from crossing different varieties. Our only recourse in such a case is the study of the actual facts.

It is sometimes stated that the hybrids between distinct races must have a relatively inharmonious constitution containing many incongruous hereditary tendencies. But the grounds for this are largely *a priori*. The mule is a very valuable animal with an unusually efficient organization notwithstanding the marked differences of the horse and the ass. There are many crosses between forms more closely related which are poor and weak products that cannot be compared with the tough organization of this familiar beast of burden. How characters of different types will harmonize cannot be told until they are combined in a cross.

With the varied considerations which may prejudice opinions to say nothing of the differences presented by the observed facts in different parts of the world, it is not surprising that students of race mixture should have arrived at opposed conclusions. The sociologist Novicow[1] sings the praises of miscegenation as loudly as other writers have condemned it. "Il est connu qu'une race s'abâtardit par les unions consanguines et qu'elle s'améliore par les croisements. . . . Les croisements sont donc indispensables pour soutenir et augmenter la vigueur d'une race. . . . Les croisements sont d'une utilité si incontestable qu'il faudra les favoriser le plus possible. De nous jours encore, nombre de sociétés non seulement barbares mais même civilizées, tâchent

[1] *Les luttes entre les sociétés humaines*, pp. 201–204.

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d'entraver les croisements. Elles se causent à elles-mêmes le plus grand de tous les maux: l'abâtardissement de la race."

In Ploss-Bartel's monumental work, *Das Weib*, it is stated that race mixture in general increases the beauty of the female sex, a statement in which he is supported by Reibmayer (*Inzucht und Vermischung beim Menschen*, p. 64). Boas says that "observations on half-breed Indians show that a type taller than either parental race develops in the mixed blood; that the fertility of the mixed blood is unexceeded; and that I cannot find any evidence that would corroborate the view so often expressed, that the hybrid of distinct types tends to degenerate." E. Fischer, who has devoted an extensive study to the Boer-Hottentot hybrids of South Africa, describes them as of good vitality, fertile and efficient, and presenting no evidence of deterioration. According to Hoffmann the intermixture of native Hawaiian women with full-blooded Chinese has produced a physically and morally superior type, and Dr. Baelz maintains that the Japanese-Caucasian cross breeds are physically and intellectually the equals of the members of either pure race.

With all the opportunity that has been afforded for the study of negro-white crosses it might be supposed that the biological status of such mixtures would be well known. But this is far from the case. The general opinion is that the mulatto is inferior in physical development, vitality, and especially prone to disease. Hoffmann quotes from the report of the Provost Marshal General eleven statements of examining surgeons in the Civil War. Ten of these express an unfavorable opinion of the physical condition of the mulatto, and in only one instance was an opinion given favorable to the mixed type and that was based on only two cases which made it of no determining value. While the mulatto is not inferior in weight and is of intermediate height, his lung capacity is less than that of either pure race. According to Gould, the average lung capacity of white soldiers in the Civil War was 184.7 cubic inches; of negroes 163.5, while in the mulatto it was only 158.9. The chest circumference was found to be for whites 35.8 inches, for negroes 35.1, and 34.97 for mixed breeds.

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These differences are correlated with differences in the number of respirations per minute which are as follows: whites 16.4, negroes 17.7 and mulattoes 19. Gould gives results on cranial measurements as follows: circumference of head, 22.1 in. in whites, 21.9 in negroes, 22.0 in mulattoes. Dr. S. B. Hunt [1] has shown that the weight of the brain in the mulatto increases with the proportion of white blood in his composition. The mulattoes less than half white have, on the average, a less brain weight than the pure negro. The results are shown in the following table:

Brain Weights of Mulattoes

No. of Cases	*Degrees of Color*	*Weight of Brain*
24	white	1,475 gm.
25	3/4 "	1,390 "
47	1/2 "	1,334 "
51	1/4 "	1,319 "
95	1/8 "	1,308 "
22	1/16 "	1,280 "

The figure for the brain weight in whites based on 278 other cases is 1,403 gm. Results confirmatory of these findings have been reported also by Topinard.

In regard to the fecundity of the mulatto we have varied opinions. Morris (*The Aryan Race*, p. 216) tells us that he "has the weakness and infertility of the hybrid." Nott finds that in South Carolina the mulattoes show a decided infertility, although in Louisiana they are fairly prolific. Woodruff (*Expansion of Races*, p. 251) states quite positively that "The Mulatto invariably dies out unless new black blood is infused into the mixed race, and though some families survive a few generations, as a rule there is absolute extinction of such feeble offspring."[2]

[1] "The Negro as a Soldier." *Anthrop. Rev.* 7, 1869.

[2] As Prof. Kelsey has remarked (*The Physical Basis of Society*, p. 298), "Whenever we are told that a people of mixed white and Negro blood must perish from the earth let us not forget that across Africa in the Sudan and down the East Coast there are untold millions of people of just that descent."

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On the other hand, Quatrefages adduces evidence to show that the products of negro-white crosses are unusually prolific and H. E. Jordan states that "the mulatto is probably more prolific than the normal average of either white or negro. During the past twenty years he has increased at twice the rate of the negro." F. L. Hoffmann who has studied the subject in a painstaking manner comes to perhaps the only justifiable conclusion that "the imperfect state of vital statistics, even at the present time, makes it difficult if not impossible to settle scientifically the question of increase or decrease in fecundity."

It is undeniable that since 1850 mulattoes have increased relatively faster than the negroes, as is shown in the following table:

Increase of Mulattoes in the U. S.

Years	*Total Negroes*	*Blacks*	*No. of Mulattoes*	*Per Cent Mulattoes*	*Mulattoes to 1,000 Black*
1850....	3,638,808	3,233,057	405,751	11.2	126
1860....	4,441,830	3,853,467	588,363	13.3	153
1870....	4,880,009	4,295,960	584,049	12.0	136
1880....	6,580,793				
1890....	7,488,676	6,337,980	1,132,060	15.2	179
1900....	8,833,994				
1910....	9,827,763	7,777,077	2,050,686	20.9	264

This table does not tell us anything, however, of the birth rate of the mulattoes as compared with that of the negroes. The mulattoes increase in number not only through their own birth rate, but through the unions of whites and negroes, through the unions of whites and mulattoes, and especially through the unions of mulattoes and negroes, the children of the latter unions being usually counted as mulattoes. Even if crosses of negroes and whites are becoming less frequent the relative increase of the mulattoes may be due largely to negro-white crosses. Mulattoes are relatively more common in the Northern States and especially

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in the West, the proportion to 1,000 negroes being in 1910, 252 in the South, 363 in the North and 473 in the West. They are also more common in urban than in rural communities. The decreasing proportion of mulattoes in the North and West which has occurred recently is probably due to the migration of negroes from the South. The urban negroes are often found in the slums or living in close association with the "tenderloin" districts where they mix with the lower elements of the white race and especially with those of foreign extraction whose antipathy to persons of color is not so strong as it is in the native American.

There has been considerable complaint in the South over the amount of miscegenation that is still going on. It is not rare for white men to support a colored mistress, and temporary associations between the races are naturally much more frequent. It is very difficult to ascertain to how great an extent the increase in the number of mulattoes is due to irregular connections between the races. We know little of the actual birth rate of mulattoes as distinguished from that of the pure negroes. And consequently we can draw no conclusion as to the natural fecundity of the products of negro-white crosses.

That the mulattoes in Jamaica do not perpetuate themselves has been asserted by Elwick, and a similar statement has been made by Dr. Ivan for those of Java. If these statements are true—and they are difficult to verify,—the reason may well be other than the reduction of natural fecundity. The Rehboter hybrids studied by Fisher show a high fecundity. Their stock resulted from the unions of Hottentot women and a small band of Dutch, Germans and other Europeans, 27 in all, reinforced later by a few other Europeans who also married Hottentot women or women of mixed origin. The average number of children born to the parents of hybrid origin was 7.7. The death rate was low, and the stock was physically well developed. In this isolated community freed from the vicious environment under which race crossing so commonly occurs, the union of two distinct races produced a healthy and rapidly increasing stock.

The Anglo-Polynesian hybrids on Pitcairn and Norfolk Islands

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sprang from a small group of nine Englishmen, six Tahitian men and fifteen Tahitian women who settled originally on Pitcairn Island in 1790. In 1855 the population which had increased to 200 removed to Norfolk Island whose population in 1905 numbered 1,059, most of whom were descended from the original settlers. Sixteen returned to Pitcairn Island in 1856 where they rapidly increased and became a healthy, flourishing people.

In his studies of half-breed Indians, Boas states that "the average number of children of five hundred and seventy-seven Indian women and of one hundred and forty-one half-breed women more than forty years old is 5.9 children for the former and 7.9 for the latter. It is instructive to compare the number of children for each woman in the two groups. While about ten per cent of the Indian women have no children, only 3.5 per cent of the half-breeds are childless. The proportionate number of half-bloods who have one, two, three, four or five is smaller than the corresponding number of Indian women, while many more half-blood than full-blood women have had from six to thirteen children."

That the hybrids between the races of man tend to sterility still awaits proof. We have no adequate evidence of sterility even in the hybrids between those races which are most distantly related. It has been claimed that marriages between different people of the same race, such as the Nordic and Mediterranean or Alpine are relatively infertile, but the evidence is far from proving that the causes are physiological and not social. From a study of a large number of marriages of different European peoples Prof. A. E. Jenks has drawn the conclusion that pure bred stock is much more fecund than cross bred stock. Since the conclusion if valid would have a far-reaching significance, it is desirable to consider critically the evidence on which it is based. The material consisted of 40,000 families of Minneapolis, Minn., 480 families of Sioux Falls, S. Dak., and 95 families of Benton Township, Lincoln Co., Minn. An enumeration was made of the number of unmarried offspring in the families of various nationalities in which both parents came from the same country and also in the families

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in which the parents came from different countries. The results are here given in tabular form:

Relative Fecundity of Pure-Bred and Half-Bred Families in Minneapolis

	Pure-Bred Families				*Half-Bred Families*			
Group	*No. of families*	*No. of children*	*No. of children per family*	*No. of amalgamating groups*	*No. of families*	*No. of children*	*Average children per family*	*Expected average*
1 Dutch	30	106	3.53	13	181	331	1.83	2.4
2 French-Canadian	282	894	3.15	16	291	627	2.15	2.7
3 Irish	1,022	2,670	2.61	23	2,100	4,282	2.04	2.4
4 Swedish	4,961	12,564	2.53	15	2,004	3,625	1.81	2.4
5 Norwegian	3,028	7,414	2.44	22	2,148	3,868	1.80	2.4
6 German	3,505	8,559	2.44	33	3,520	6,235	1.77	2.1
7 Canadian	372	838	2.25	13	861	1,670	1.94	2.3
8 Scotch	184	411	2.23	18	897	1,602	1.78	2.1
9 French	155	334	2.14	21	665	1,251	1.88	2.2
10 Danish	246	509	2.06	9	265	471	1.77	2.1
11 English	523	1,014	1.93	20	1,882	3,252	1.72	2.0
12 Welsh	77	127	1.64	17	233	399	1.71	1.8
13 American	8,614	13,156	1.52	28	3,859	6,392	1.66	1.9
14 Scotch-Irish	16	24	1.50	15	229	395	1.73	1.8

The differences between the sizes of homogamic and heterogamic marriages are striking. But are they due to differences in the natural fertility or like and unlike unions? It is especially noteworthy that the number of native Americans given in the table is far greater than any other nationality. It is also noteworthy that there are great differences in the size of the families among the people in different countries,—differences which are probably due to a small extent to physiological causes, but are mainly the result of other factors which have been discussed in a previous chapter. In a marriage between a Dutch man or woman and a person of another nation the chances are, other things equal, that the person would be an American, owing to the numerical proponderance of the latter stock. Since the size of the American family is notoriously small, the influence of American custom would be a strong element in determining the number of children in the mixed marriage. Persons from nationalities with large families, if marrying outside their group, would be apt to

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marry into a stock which produces less children. Jenks recognizes this fact and has calculated the expected size of the family resulting from mixed marriages.

In speaking of Dutch families he says "Not only is the Dutch half-breed family much less fecund than the Dutch pure-bred family, but the average for the Dutch half-breed families is noticeably lower than the expected average for said families. This expected average is computed from the fourteen ethnic groups composing the 181 Dutch half-breed families. The expected average is 2.4 children per family, while the actual average is only 1.83 children—the fact of amalgamation apparently being the cause for reduced fecundity." Just how the expected size of the family is calculated is not explained in detail, but apparently the author has calculated the average fecundity of the stocks into which any given group marries and taken the mean between this and the average size of the pure-bred Dutch family. But however he computes the expected averages of cross-bred families, why can we say that any numerical expression represents the expected number of children from a given cross mating? The proceeding involves the assumption that the size of the families of the stocks in question is an index of their natural fecundity. If this is not the case, the argument becomes vitiated. If the average size of the pure-bred Dutch families is 3.53 and the size of the American family is 1.52 are we justified in expecting that the average size of the Dutch-American family is the mean of these two numbers, or 2.5? Take a stock in which birth restriction is an ingrained custom and suppose that marriages occur between its members and those of a people which does not practice artificial restriction of the family. Who can say what is the "expected" number of children? It seems not improbable that the size of the family would be nearer that of the stock with a tradition of family limitation, because one member, at least, would be familiar with the practice. There are various social influences also which might affect the size of the cross-bred groups, and it is not improbable that those who marry with people of alien stock may not be typical of the general average of their group. Much

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would depend upon the stock into which people are prone to marry, but on this we are given no data.

It is quite unwarrantable to draw the conclusion that "pure bred and prepotent are practically synonymous," or that the American who is an "extremely amalgamated group in consequence of amalgamation is a decidedly impotent group." The American birth rate is low for the reasons that have led to the reduced birth rate in France and elsewhere. The decline of the birth rate in Europe has been quite as rapid in countries whose population is relatively homogeneous as in countries where there has been a great mixture of peoples.

Jenks has studied the amount of in-marrying and out-marrying in eight chief ethnic groups in Minneapolis and finds that their order arranged according to increasing percentage of out-marriages is as follows: Swedes, Norwegians, Germans, Danes, Irish, English, Welsh, Scotch. "This series of ethnic groups, arranged in order of decreasing amalgamation and increasing cohesion from the Scotch to the Swedes is the exact duplicate of the series of the same Minneapolis ethnic groups in order of increasing fecundity, except for the Irish and Scotch as seen in Table A. It seems that the most fecund ethnic groups are those least given to amalgamation, and vice versa." It may be noted, however, upon inspecting the table, that as a rule, where there is a relatively high fecundity of in-marriages there is also a relatively high fecundity of out-marriages. As a comparison of the relative number of native and foreign born among the various ethnic groups shows, those groups composed mainly of foreign born members have the highest birth rate and (very naturally) the highest percentage of in-marriages. These are the groups which must be composed of relatively recent immigrants who would retain their traditional fecundity. Where, as in the Swedes and Norwegians the foreign born outnumber the native born members of their stock over two to one, we should naturally expect the birth rate to be high. With the next group, the Germans, the foreign born are only a little less in number than the native born (5,988 to 4,111). With the Irish, English, Welsh and Scotch the

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native born are greatly in excess. Denmark occupies an anomalous position in that most of her people were foreign born. We should expect her to come after the Irish and ahead of the English, according to Jenks and to occupy a position ahead of the Germans according to the proportion of foreign born. The relatively large number of out-marriages considering the probably recent arrival of her immigrants is perhaps due to the comparatively small number of Danes in the city. Where a people is represented by a comparatively few individuals the number of out-marriages would naturally be high. The relatively high fecundity of the Irish, despite their long sojourn in this country (as indicated by proportions of their native born), is probably due to their high percentage of Roman Catholics as is also the case with the French-Canadians.

Recency of arrival is probably a potent factor in determining the size of the family and the amount of intermarriage in the various stocks represented in the city of Minneapolis. This conclusion is all the more probable since the birth rate of the foreign stocks in Minneapolis does not show a close correspondence with the birth rate of these stocks in their native countries. Those stocks which have the largest percentage of American born of one or more generations show, as a rule, both the highest number of out-marriages and the lowest birth rate. The out-marriages, with a few exceptions due probably to the small numbers represented, are more frequent in all groups among the first generation of American born than in the foreign born, and greater in the third generation than in the second or first. The most mixed groups, are as a rule, the groups having the largest proportions of older immigrant stock; they are the most Americanized, and their birth rate is also low, not because they are of mixed blood, but because they have become most thoroughly imbued with our traditions. As so frequently happens when one is dealing with demographical statistics, the conclusion which seems at first to follow is not borne out by a more critical examination of the evidence. We have as yet insufficient grounds for concluding that race mixture or the mingling of

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inter-racial groups is followed by any reduction of natural fecundity.

What can we say of the effects of race-mixture on mental development? We have no grounds for alleging that the products of mingling the various ethnic stocks of Europe are in any way inferior to their component elements. Certainly it would be easy to compile a very extensive list of most eminent men of mixed ethnic origin. There is no adequate evidence for concluding that hybrids even of distinct races are mentally less developed than the average of the inferior race. In general, experience seems to show that they possess a degree of intelligence more or less intermediate between that of the races from which they are derived. Where there has been much intermingling of races of different cultural levels the mixed breeds tend to occupy a relatively advanced position.

The best opportunities for the study of mentality of a mixed race are afforded by the mulattoes of the United States. Most students of the subject agree that the mulatto is considerably superior in intellect to the full-blooded negro, however they may explain this superiority. From a study of the achievements of mulattoes and negroes by E. B. Reuter I quote the following:

In a recently published compilation of one hundred and thirty-nine of the supposedly best-known American Negroes there are not more than four men of pure Negro blood, and one of these, at least, owes his prominence to the fact of his black skin and African features rather than to any demonstrated native superiority. Of the twelve Negroes on whom the degree of doctor of philosophy has been conferred by reputable American Universities, eleven at least were men of mixed blood. Among the professional classes of the race the mulattoes outclass the black Negroes perhaps ten to one, and the ratio is yet higher if only men of real attainments be considered. In medicine the ratio is probably fifteen to one, in literature the ratio is somewhat higher, on the stage it is probably thirteen to one, in music the ratio is at least twelve to one. In art no American Negro of full blood has so far found a place among the successful. . . .

The successful business men of the race are in nearly all cases men

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of bi-racial ancestry. . . . In all times in the history of the American Negro and in all fields of human effort in which the Negroes have entered, the successful individuals, with very few exceptions, have been mulattoes. . . .

In South Africa the mulattoes are on a distinctly higher cultural level than are the natives of unmixed blood. In the British West Indies the more cultured mulattoes have been formed into a middle class group, separated from and superior to the black peasantry. . . .

In North Brazil the mixed-blood group of Portuguese, Indian and Negro ancestry are on a distinctly higher social and intellectual plane than are either the Negroes or the native Indians. . . . In the Philippines the half-castes of Chinese-Moro, as well as those of Spanish-Moro, origin are well in advance, intellectually, of the pure-blood natives. Every man in the Filipino group who has risen above mediocrity under the Spanish, as under the American, occupancy of the islands has been a man of bi-racial ancestry.

While admitting that the simplest explanation of the superiority of the mulatto is that it is due to the infusion of a superior mental inheritance from the white race, the author holds that this does not account for all of the superiority, and attempts to work out another interpretation of the results based on the assumption that the black and the white races are essentially equal in native intelligence. Mulattoes, it is claimed, enjoyed superior advantages during the period of slavery and afterward, but the chief cause of their superiority is the fact that "from the Negro side the mulattoes are descended from the best of the race."

"The choicest females of the black group became the mothers of a race of half-breeds. The female offspring of these mixed unions became chosen in turn to serve the pleasure of the superior group. By this process of repeated selection of the choice girls of the black and mulatto group to become mothers of a new generation of mixed-blood individuals, there has been a constant force making for the production of a choicer and choicer type of female." Thus a process of marriage selection is instituted which the author thinks goes far toward explaining the intellectual superiority of the mixed type.

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All this seems like a desperate attempt to avoid a perfectly natural and almost obvious conclusion. The doctrine of the mental equality of black and white does not commend itself to most of those who have had much experience with the colored race, and it is contradicted by the results of a number of studies on the intelligence of whites and blacks by the application of mental tests as is in fact admitted by Reuter.[1]

Much of course remains to be done before a precise comparison of the mental status of the races of man can be made. If there has been a selection of the better negro types in the production of the negro-white crosses there is even more evidence that the white parents are not to be considered as representing a very high average type of their race. Even granting that during slavery the best negro women were more apt to become the mothers of mulattoes, it cannot be contended that this was true after emancipation when more mulattoes were produced than at any previous time. Since the Civil War the mulattoes were apt to be the product of the worst elements of both races. Hoffmann collected information concerning 37 black-white unions of which eight were white men living with negro women and 29 were those of white women living with negro men. Of the eight white men living with negro women "three were criminals or under strong suspicion of being such. . . . The others were more or less outcasts. One was a saloon keeper, one had deserted his family for his negro mistress, two were men of good family but themselves of bad reputation." The record of the twenty-nine women married to or living with colored men was still worse. And of the twenty-nine colored men living with white women, "only one, an industrious barber, was known to be of good character."

The number of cases is small, as Hoffmann states. "It is my own opinion," he says, "based on personal observation in the cities of the South that the individuals of both races who intermarry or live in concubinage are vastly inferior to the average

[1] In his recent valuable book on *The Mulatto*, Prof. Reuter has brought together much additional evidence of the mental superiority of the mulatto to the negro. The cause of this superiority is not discussed in detail.

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types of the white and colored races in the United States; also that the class of white men who have intercourse with colored women are, as a rule, of an inferior type." Those familiar with the life and ways of negroes and mulattoes especially in our cities where the mulattoes are relatively abundant will be inclined to agree that the facts stated by Hoffman represent more nearly the typical kinds of black-white matings that occur and have occurred since the Civil War, than the theories of Reuter as to how they might have occurred. If there is enough ability in the selected negro stock to account for the superiority of the mulatto when mated with ordinary white parentage we should certainly find a considerable number of cases in which both black parents were of a superior type and who would be expected to produce offspring at least the equal of the better mulattoes. Pure blacks of proven native ability of high order are in fact rare. The fact that mulattoes, despite their relatively inferior white parentage, are in all countries, superior to the blacks, is strongly indicative of a marked difference in the average intellectual capacity of the two races.

It is scarcely necessary to point out that the intellectual superiority of the mulatto over the negro affords no sufficient ground for advocating the amalgamation of the negro and white races. If the mulatto has a better mind than the negro, he is apparently inferior to him in physique and is inferior in every way to the whites. Any system of cross breeding which means the substitution of mulatto for white children cannot be viewed as anything but a serious menace. It is to be condemned, not only from the biological standpoint, but because it would lead to social and moral deterioration. To say that negro-white crosses are undesirable on biological grounds, however, is not to assert that race crossing is bad *per se*. If races are on the same level of inherent physical and intellectual endowment their fusion may produce a very desirable combination of qualities and might give rise to a diversity of traits which would be socially valuable. We have insufficient grounds for condemning crosses of races or peoples *per se*, but only those crosses which substitute an inter-

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mediate product for the most highly endowed stock. It is the very best inheritance that should be conserved at all costs. Out of it come the rare minds that rise like mountain peaks above the general level of humanity. And it is to these minds, small in number, but incalculably great in influence, that advancement in civilization and culture is largely due.

I cannot close this chapter without a few remarks on the increasing fusion of racial elements and the possible eventual outcome of this process. As the human species became dispersed into various quarters of the globe it became more and more divided into isolated groups. Given a heterozygous stock, isolation would of itself afford a condition under which the race would be broken up into varieties through the influence of segregate breeding. As a result of spreading into regions of different climatic and other environmental conditions, the race would also tend to become modified in different ways through the action of natural selection. In the early periods of the history of man when he was spreading over and becoming adapted to the diverse regions of the earth, the predominant trend of development was toward divergence. The result is a multiplicity of groups within groups, which ethnologists are still far from having arranged in a satisfactory system of classification.

For long periods and with increasing frequency as mankind has advanced, there have been migrations, conflicts and intermixtures of previously differentiated peoples. But at the present time, when railroads and steamships, to say nothing of other conveniences of travel and communication, are bringing races into closer and closer contact, the process of race fusion goes on at an accelerated pace. Many of the old barriers of religion and national or sectional prejudice are breaking down. People of minor racial distinctions such as those of the countries of Europe are rapidly commingling their blood and over large areas such as South America, parts of Africa and Asia and in numerous islands of the Pacific there is an extensive blending of distinct races. If in the early history of mankind development was along diverging lines it is now proceeding more conspicuously and rapidly in the

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reverse direction. Will the outcome be, as some think it will, the ultimate fusion of all races into one? As Metcalf remarks, "The amalgamation of the races of man into one race as homogeneous as the present European population will doubtless take a few thousand years to accomplish, but as far as we can judge from the conditions now existing and those seemingly necessarily about to come, such union of the races seems inevitable."

It is evident that the intercommunication between races will in the future increase rather than decrease, and it is probable that amalgamation of races will go on more rapidly than before. The superior races may take more efficient means to protect themselves from the infusion of inferior blood, but among the less advanced races and peoples intermingling seems destined to wipe out the individuality of many existing stocks. The distinct races will doubtless become narrowed down to a relatively small number, and what diversity remains will be maintained either through conscious efforts to retain racial integrity, or the action of climate or other conditions which will tend to keep certain parts of the earth in possession of those races which are especially adapted to thrive there. The tropics are apparently unsuited for continuous habitation by the white man. The diseases which have tended to exclude the Caucasian may all in time be conquered. But there will always remain the outstanding factor of climate which, in the long run, proves to be a very effective barrier to the expansion of races. It is not improbable that large parts of tropical Africa will have to be left permanently in the hands of the negro race. On the other hand, the black race does not thrive in northern latitudes. It would be absurd to assume that each part of the globe is inhabited by the racial elements which are best adapted to them; nevertheless there are certain broad, general adjustments which have doubtless largely determined the ubiety of the chief racial subdivisions of the human species. With the breaking up of old racial boundaries there may be effected a redistribution of ethnic stocks so that they will be more closely associated with climatic zones. Racial distinctions may then be permanently kept if they are favored by differences

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of temperature and other environmental factors. The tendency toward universal amalgamation may be held in check by natural selection which will keep up racial distinctions which are correlated with climatic adaptation. What the final result of these opposed tendencies will be no one can foretell.

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CHAPTER XII

THE POSSIBLE RÔLE OF ALCOHOL AND DISEASE IN CAUSING HEREDITARY DEFECTS

"There is probably no biological problem of greater interest and importance, and about which less is known, than that of the causation of germinal variations—whether of a progressive or retrogressive nature."—Tredgold, *Mental Deficiency.*

In attempting to estimate the factors of evolution, whether in man or in the lower forms of life, we must of necessity face the problem of the causes of variability. Important as this subject is for evolutionary theory as well as many practical problems in experimental breeding, it has received surprisingly little attention from students of biology. Darwin, who studied variation most exhaustively, and who amassed a great wealth of facts concerning the variations of animals and plants, threw little light upon the problem beyond pointing out the probability that "variability of every kind is directly or indirectly caused by changed conditions of life." Domestication, especially if long continued, appears to enhance variability. In common with Andrew Knight, Schleiden and others Darwin held that excess of food is one of the most potent factors by which variations may be induced. Much of the variability due to food, climate, etc., was attributed by him to the inheritance of the somatic effects of these agencies,—a conclusion with which most geneticists would not now agree. Outer agencies were held also to affect the reproductive cells, and thus to cause variations which tend to become strongly inherited.

Germinal variations frequently occur in a haphazard manner. Generally no specific cause can be assigned for their appearance. When a hairless dog, a navel orange, or a runnerless strawberry arises all we can say is that such events just happened. If congenital variations arise as a response of the germ plasm to stimuli,

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we have made practically no progress in ascertaining, in any form, whatever relation may exist between the nature of the variation and the kind of external stimulus by which it is evoked.

A large part of the congenital variations that appear in organisms are mere products of the mingling of factor differences contained in the germ cells of the parents. Where such variations are not obviously the expression of typical Mendelian inheritance they are frequently explicable as unusual factor combinations which are nevertheless essentially Mendelian. Certain variations may perhaps be attributable to the loss of factors and others to the reduplication of one or more factors, as the result of some anomalous behavior of the germ plasm, such as occurred in the mutant *Œnothera gigas* and several other similar cases. But all such variations as these are probably of minor significance in relation to the general problem of progressive evolution. They are the results of the shuffling of the cards, and at best they can produce only new combinations of old factors.

There are writers (Lotsy, Hagedoorn) who hold that the kinds of variations just alluded to are the only ones of which we have any evidence. But if we admit the existence of this kind of variability only, we are landed in serious difficulties. There is certainly no adequate reason for denying that variation is a real phenomenon dependent upon qualitative changes in the germ plasm. Many cases are known in which the appearance of new mutants is in all probability dependent upon such qualitative germinal variations. But with few exceptions their occurrence seems entirely fortuitous and we can form no conjecture as to their possible cause.

There is a certain amount of experimental evidence that germinal modifications may be evoked by environmental agencies. The experiments of Tower on the production of mutants in the Colorado potato beetle, and the work of MacDougal and Gager in inducing mutations in Œnothera and other plants by salt solutions and radium are among the few investigations on multicellular organisms which have yielded positive indications of germinal response to changes in the environment.

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Much of our data on this problem is derived from observations on the supposed effect of alcohol and other injurious substances on the offspring of animals or human beings subjected to these influences. In the experiments of Hodge and of Pförringer on dogs, and of Laitenen on rabbits and guinea pigs the animals were given alcohol during pregnancy and the number of stillborn or imperfect young was unusually high. Of the three dogs used in the experiments of Hodge one died during parturition. After the two others had produced several stillborn or abnormal young the alcohol was discontinued. In both cases the litters which were born after alcohol was no longer given were mostly dead. Where there is an opportunity for the fœtus to be affected directly by alcohol in the mother's blood there is no evidence of any truly hereditary effect. If alcoholized mothers continued to produce defective young after the use of alcohol is withdrawn, the result may still be due to the direct effect of the injury sustained by the mother.

There have been some experiments on the direct effect of alcohol on the germ cells. Miss Torelle has studied the influence of alcohol on the sperm cells of the starfish. She found that small amounts of alcohol added to a sea water containing the sperm cells did not diminish their vitality and when eggs were fertilized by these sperms they developed rather better than the controls. Ivanow treated the sperms of the rat, sheep, dog, rabbit and guinea pig with alcohol up to as high as seven per cent. The females artificially impregnated with these sperm cells brought forth a normal and vigorous progeny. In the mature condition Ivanow infers that sperm cells are quite resistant to alcohol. This should render us rather skeptical about the sad havoc alleged to be produced in human offspring by paternal drunkenness at the time of conception. The sperms already isolated from any organic connection with the rest of the body, and relatively resistant, would probably be less affected than at any previous time. The experiments of Gee showed that spermatozoa of fishes were relatively uninjured by alcohol up to strengths which were nearly fatal to them. However, with

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alcohol of just the proper strength, the spermatozoa could be injured so that eggs fertilized by them developed in an abnormal manner.

While most of the experiments on the hereditary influence of alcohol in animals are singularly lacking in conclusiveness, the recent work on guinea pigs by Stockard in collaboration with Craig and Papanicolaou has afforded data of a much more convincing sort. The animals used were first mated and shown to be capable of producing normal offspring before they were subjected to alcohol, and only healthy and fertile stock was employed. For six days per week the guinea pigs were subjected to the fumes of alcohol until they began to show signs of intoxication, although they were never allowed to become completely intoxicated. After this treatment was continued for some time the animals were mated. Normal males were mated with alcoholized females and vice versa; and there were also matings of alcoholized males with alcoholized females.

Out of ninety matings of normal females with alcoholized males thirty-seven gave negative results or early abortions; ten of the litters from the other matings were stillborn, and out of the forty-three litters containing living young, about thirty-five lived but a few days, while the survivors, forty-seven in number, contained many small and defective individuals.

In thirty-three matings between normal males and alcoholized females seven gave negative results. Four produced only stillborn young, and of the young from the twenty-two living litters, twenty-three died soon after birth. When both parents were subjected to alcohol, out of forty-one matings twenty gave no results, or early abortions. Fourteen resulted in stillborn litters, and the seventeen living litters contained only twenty-six young of which twelve died soon after birth.

Contrasted with the foregoing is the outcome of ninety matings of normal guinea pigs giving sixty-six living litters with ninety-nine surviving offspring.

These results are sufficiently striking, not only because of the considerable numbers of animals employed, but on account of

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the very decided preponderance of sterile matings and stillborn or short-lived young in the experiments with the alcoholized animals. And the results are all the more convincing because the alcoholized animals had been previously bred and proven capable of bearing normal offspring.

The following table gives a summary of results up to 1916:

Effects of Alcohol on the Descendants of Treated Animals

Condition of the animals	*No. of matings*	*Neg. Result or early abortion*	*Stillborn litters*	*No. of Stillborn young*	*Living Litters*	*Young dying soon after birth*	*Total dead*	*Surviving young*
Alc. ♂ × norm. ♀	90	37	10	20	43	35	55	47
Norm. ♂ × alc. ♀	33	7	4	12	22	23	35	21
Alc. ♂ × alc. ♀	41	20	4	8	17	12	20	14
Summary	164	64	18	40	82	70	110	82
Control norm. ♂ × norm. ♀	90	22	2	8	66	19	27	99
♀ treated during pregnacy	4	0	0	0	4	1	1	7
2nd gener. × norm.	46	10	3	8	33	29	37	25
2nd gener. × alc.	53	16	8	17	29	22	39	28
2nd gener. × 2nd gener.	95	29	7	16	59	43	59	52
3rd gener. × 3rd gener.	48	20	7	14	21	19	33	13
3rd gener. × 2nd gener.	33	15	4	8	14	16	24	7
3rd gener. × norm.	17	3	4	8	10	5	13	7
3rd gener. × alc.	3	1	0	0	2	2	2	1
2nd, 3rd gener. × 2nd, 3rd gener.	18	9	2	6	7	6	12	4

More recently additional data were obtained in part from animals of unrelated stock, but the results only confirmed the previous findings. Some of the general comparisons are shown in the following table:

Progeny of Normal and Alcoholic Guinea Pigs

	Normal Lines	*Alc. Lines*	*Normal Inhert.*	*Alc. Inhert.*
Total number	233	594	41	302
Lived over 3 months	181	383	32	184
Aborted, premature, stillborn	27	138	6	77
Died within 3 months	25	73	3	41
Total died	52	211	9	118
Defective	0	15	0	10
Undersized	1	8	1	11

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One fact of much interest is that guinea pigs from alcoholized parents produce a relatively defective progeny even though they may not have been given alcohol themselves. "Animals as far as three generations removed from the direct alcohol treatment are still differentiated as a group from the control in regard to the weight of the litters in which they are born, the tendency of the litters to result in failure, the high proportion of prenatal mortality over postnatal, and the total mortality which is one and one-half times higher than the normal." Deformities and defects appear much more commonly in the alcoholic strains. Among these were paralysis agitans, opaque cornea, cataract and opaque lenses, small defective eyes, complete absence of one eye, and, finally, complete absence of both eyeballs. In some cases there were deformities of the limbs, albinos, and dwarf forms with a low degree of vitality. No defects were noted in the normal line. Defects sometimes arose in strains in which the males only had been alcoholized, in some cases the treatment having been given only to the grandparents or great-grandparents of the deformed animal.

It is a noteworthy fact that when males alone are subjected to alcohol the effect on the early mortality of the offspring is often very marked, although in other respects the greatest injury is done when the females only are treated. In the latter case there is opportunity not only for the germ cells to become affected so as to produce a true hereditary change, but the embryo may be directly injured by the alcohol in the mother's blood. Deterioration in offspring as a result of intoxication of the male parent can scarcely be due to anything but a change produced in the germ cells. The fact that defects thus arising may be transmitted to further generations is indicative of the production of a true hereditary effect through a modification of the germ plasm.

The investigations of Pearl on the hereditary effects of alcohol on the domestic fowl yielded results apparently at least opposed to those obtained by Stockard and his co-workers with guinea pigs. The alcohol was administered by the inhalation method. The fowl subjected to alcohol weighed on an average less than

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the controls, and they showed a reduced activity, but the mean egg production of the two groups was practically the same. The mortality of the treated fowl was less than that of the controls. But this result may not be significant on account of the small number of individuals dealt with. "The proportion of fertile eggs was materially reduced in the matings in which one or both individuals had been treated. The higher the germ dosage index for the mating the smaller was the percentage of fertile eggs found to be.

"The prenatal mortality measured by the percentage of embryos (zygotes) which died before hatching to all embryos formed, was materially smaller in the case of offspring from matings in which one or both parent individuals were treated, than in the case of offspring from untreated control parents."

Perhaps the most striking result was that the mortality of all ages after hatching was lower in the offspring of parents both of which had been subjected to alcohol and while the weight at hatching was much the same in both groups the adult body weight was higher in the offspring of the alcoholized fowl. Abnormal offspring appeared no more frequently in the progeny of alcoholized parents than in the untreated strains. In view of the somewhat superior character of the fowl from alcoholized parents, Pearl concludes that there is "no evidence that specific germinal changes have been induced by the treatment, at least so far as concerns those germ cells which produced zygotes."

However, he admits that alcohol probably injured some of the germ cells as is evinced by the high proportion of infertile eggs in cases in which either the male or the female parent had been treated with alcohol. Alcohol was supposed to eliminate the weaker germ cells, thereby diminishing the proportion of individuals developed from inferior germ plasm. Whether alcohol improves or deteriorates the stock would, therefore, depend upon the relation between its action as a selective agent in eliminating weaker sex cells or preventing their union and its action as a direct source of injury to the germ plasm.

Both Pearl and Stockard consider their results as not opposed

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to one another, the apparent discrepancy being due to the different degrees of resistance of the bird and the mammalian germ cells to alcohol. Where the direct injury to the germ plasm is not too great the action of alcohol in eliminating the weaker germ cells may outweigh its direct injury to the more vigorous ones. This, if I understand it, is the essential feature of Pearl's attempt to harmonize his own results with those obtained with guinea pigs. Stockard points out that there may have been in Pearl's experiments, not so much an elimination of weaker germ cells, as a very early prenatal mortality, which would naturally be mistaken for infertility of the eggs. Such early mortality was actually demonstrated in the guinea pigs, especially in the alcoholic strains. But, however this somewhat difficult problem may be solved,—whether elimination occurs before or soon after the germ cells unite,—both Pearl's and Stockard's results may be due to a tendency of alcohol to act injuriously on the germ plasm. The influence of alcohol on the race, however, is very different according to whether or not the direct injury of alcohol to the germ plasm is outweighed by its operation as a selective agent.

Confirmatory evidence of the effect of alcohol on the germ cells is afforded by the experiments of Cole and Davis on rabbits by means of double matings. When females were mated at nearly the same time with normal and with alcoholized sires it was found that the sperm of the males that had been given alcohol usually failed to fertilize the ova, owing probably to the influence of alcohol on the vitality of the spermatozoa.

In regard to the hereditary influence of alcohol in man our evidence is less direct and less conclusive. The great majority of writers on the relation of alcohol to heredity are firmly convinced that the evil effects of alcoholism are transmitted from parents to their children. In recent years, however, expression of opinion on the part of the more scientific students of the subject has become rather more guarded, and by a few writers, prominent among whom is Dr. G. A. Reid, it is held that parental alcoholism has no appreciable influence on the next generation. No critically minded and unbiased person who has become well acquainted

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with modern views on the nature of hereditary transmission can read very much of the writings that have accumulated on this question without a feeling of grave doubt or suspicion in regard to the conclusiveness of most of the evidence that is brought forward. The subject is seldom discussed without bias, and most of our data has been collected by writers who were endeavoring to make the case against alcohol as bad as it could be made. But should there be no transmission of acquired characters in the strict sense of the term, it does not follow that parental alcoholism produces no effect upon the next generation. It may affect the nutrition of the germ cells and so tend to stunt the offspring. It may poison the germ cells by being carried into direct contact with them through the blood; or it may poison them indirectly by means of substances arising from the disordered functions of the body. In still another way the next generation may be affected, and that is by the influence of alcohol on the fœtus during the period of pregnancy. We cannot call such an influence hereditary transmission, although it has often been confused with hereditary transmission. Alcohol in the blood of the mother might pass through the placenta into the fœtal circulation where in fact it has been detected. The effect of alcohol on the offspring in such a case would be a direct and not an inherited one. It is as if one of a pair of Siamese twins should drink and the other one should also get drunk, a result which might very well happen. In any consideration of the hereditary effects of alcohol we shall have, therefore, to treat the effects of maternal indulgence during pregnancy as a special case. It is quite possible for alcohol to injure the unborn child without affecting the germ plasm or hereditary substance, or producing an effect that is, strictly speaking, hereditary.

There is another distinction which must be made in discussing this subject, and that is the distinction between inheriting a propensity toward alcoholism, and the transmission of the effects of parental indulgence in alcohol. If the son of a drunken father drinks to excess it does not follow that the son has inherited the effects of his father's habit of drink. Father and son may

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both drink because they belong to a strain with a hereditary weakness in this direction. The son may drink because of the environment in which he was raised; he may have been given liquor, as children of such parents often are, and early acquired a taste for it; or he may have been thrown among associates who would naturally lead him into the drinking habit. No amount of data showing a correlation between the alcoholism of parents and that of their offspring is sufficient, by itself, to prove anything whatsoever in regard to heredity. But simple as this distinction is, it is one that has been ignored by a multitude of writers. Nothing is more common than to find statistics regarding the appearance of alcoholism in successive generations adduced as a sufficient proof of the hereditary effects of alcohol. One might get the same kind of statistics about taking snuff, chewing tobacco or using bad grammar, but they would prove nothing in respect to hereditary transmission.

With these considerations in mind we may consider some of the arguments adduced to show the hereditary influence of alcohol. It is a conclusion supported by many statistics and among others by the recent data of Elderton and Pearson, that the percentage of stillbirths and of deaths in early infancy is higher in the offspring of alcoholic than in those of non-alcoholic parents. There are several possible causes of this. First, the injurious effect of alcohol on the fœtus. Second, the injurious effect of alcohol on the health of the mother. Third, the relatively unfavorable circumstances of the alcoholic's family. In London in 1903–04 over half the deaths from overlying occurred on Saturday and Sunday nights. The curve for deaths from suffocation in England is almost perfectly paralleled by the curve of arrests for drunkenness. Fourth, alcoholic mothers are more frequently unable to nurse their children, and, according to Bunge, infant mortality in the first year of life is, in some places, six times as high in children fed on cow's milk as among those that are breast fed. Holt, a well-known authority, says that deaths of cow-fed infants are three times as frequent as among children nursed by their mothers. One reason, therefore, for the greater mortality of

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the children of alcoholic mothers may be that the latter are unable to nurse their children as much as mothers not addicted to drink. The rôle of heredity here is obscured by so many other factors that the real hereditary influence of maternal alcoholism remains in doubt.

One of the strongest indictments against alcohol is that the offspring of people addicted to drink show a high percentage of idiocy, imbecility, epilepsy and insanity, and that when they escape these graver ills they usually fail to reach a normal degree of mental development. The relation of parental alcoholism to epilepsy forms the subject of an extensive monograph of Dr. Sollier on the Influence of Heredity on Alcoholism. This monograph is based entirely on the author's own investigation of three hundred and fifty families of alcoholics, one of the members of which was or had been in the wards of the asylum for epileptics at Bicêtre. The histories of a large number of cases are given in detail and they contain records of drunkenness, disease, crimes, insanity, feeble-mindedness and a variety of other abnormal traits. "Out of these three hundred and fifty families," Sollier says, "there were two hundred and nine in which we could find no acknowledged hereditary ancestor whose condition would account for the alcoholism. We have however admitted the disease without inheritance in two hundred and nine cases, say in 59.71 per cent of the whole number. In one hundred and forty-one cases the alcoholism was linked with conditions of heredity; in one hundred and six cases by heredity in similars; in thirty-five cases by heredity in dissimilars. . . . The patients in whose families we have sought to trace the exciting causes of the disease, were all degenerates of a low order, idiotical, incompletely developed, feeble, epileptic."

The facts stated in the last sentence quoted should warn us to be particularly careful in drawing conclusions. How much of the degeneration in these families is due to the effect of alcohol and how much to bad heredity independent of alcohol we do not know. To what an extent the alcoholism which in a number of cases occurs in two generations is to be attributed to heredity we

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do not know. And even if we admit that the proclivity to alcoholism in these cases is inherited, it does not follow that the inheritance of this proclivity is in any way the effect of alcohol.

Barr in his work on *Mental Defectives* quotes Hippolyte Martin to the effect that among one hundred and fifty insane epileptics, eighty-three had a paternal history of intemperance, and he states that in his (Barr's) own records "only fifteen of my two hundred and fifty cases of imbecile epileptics had such a history." Horsley and Sturge in their recent book on *Alcohol and the Human Body* say that "there is very strong evidence to show that parental alcoholism is one of the most frequent causes of epilepsy in children." Of the two authorities cited in support of this conclusion, one, Dr. W. C. Sullivan, found that out of two hundred and nineteen children who had alcoholic mothers 4.1 per cent became epileptic, whereas in the general population epilepsy occurs in less than one-half per cent,—numbers two small to eliminate the effect of mere chance. And besides, it was not taken into consideration that both epilepsy and alcoholism may have resulted from a nervous heredity.

The other authority appealed to, Dr. Legrain, personally followed up the descendants of two hundred and fifteen drunkards and found that in their families epilepsy, insanity and other nervous disorders were extremely common. Here again the same uncertainty occurs. Is the alcohol the cause of the epilepsy and insanity, or do constitutions with a proclivity to epilepsy and insanity take most readily to alcohol? It may be that much of the epilepsy and especially of the insanity was caused directly by drink, and that the offspring of drinkers being more apt, for various reasons, to drink, naturally exhibit a higher percentage of nervous disorders. It is one thing to show that hereditary nervous disorders are more common in stocks addicted to alcohol, and quite a different thing to prove that alcohol is the cause of these disorders when they appear in the next generation.

Demme's results which are often alluded to are vitiated by the fact that they are based on especially selected evidence. A comparison is made between the offspring of two drunkards and two

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sober parents. In the former there were 8 idiots, 13 epileptics, 2 deaf mutes, 5 dwarfs, 3 physically deformed, 12 who died in infancy, 5 who became drunkards affected with chorea and epilepsy, and only nine who were entirely normal. The families of the normal parents showed nothing extraordinary as might have been expected. It is evident that, granting the drunkards' families were typical of alcoholic parents, which it is absurd to suppose that they are, the relation would not prove the causative rôle of alcohol in the production of the various pathological conditions that were found.

Comparatively few writers have been alive to the alternative possibilities of interpretation in the statistics with which they were dealing. H. I. Berkely, for instance, in his *Mental Diseases* states positively that it is a well-recognized fact that drunkenness is frequently responsible for the lowest form of congenital idiocy. As evidence of the hereditary effects of alcohol Horsley and Sturge quote the following from the report of the Royal Commission on the Feeble-Minded: "Examining out of many family histories one hundred and fifty cases of mental defect in which he was able to satisfy himself that he had collected historic data, Dr. Tredgold, physician to the Littleton Home for Defective Children, found in 46.5 per cent of the families a history of well-marked alcoholism; in 38.5 per cent of the cases combined with neuropathic inheritance." In a study of the histories of two hundred and fifty feeble-minded children Dr. Potts found a history of alcoholism in one hundred and four of them. Eighteen per cent had a history of tuberculosis in addition to alcoholism and 11.87 per cent were both alcoholic and insane. "It is quite plain," says Dr. Potts, "that in combination with other bad factors it [alcoholism] is a most unfavorable element, while maternal drinking, and drinking continued through more than one generation are potent influences in mental degeneracy."

Both the conclusion of Dr. Potts and his attitude toward the problem are typical of the reasoning so commonly exhibited in the treatment of alcohol in relation to heredity. Apparently it did not occur to Dr. Potts, or to Horsley and Sturge that the facts

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presented could be interpreted in any other light. All that is directly proven by the statistics is that alcoholism in parents is frequently correlated with various kinds of neuropathic traits in the children. How this correlation is to be explained the statistics do not tell us. It is quite possible that the correlation may be due to the fact that people whose heredity disposes them to idiocy, insanity and other nervous disorders are those in whom inebriety is most likely to develop. One might pile up volumes of statistics such as we have quoted without really establishing the fact that alcoholic habits are a cause of hereditary defect. The problem is not so simple as is commonly represented. In the first place we must eliminate the influence of the unfavorable environment under which the children of alcoholics are so frequently brought up, and this in most cases is no easy task. And then there is the further question of ascertaining whether the use of alcohol is the cause of degeneration or its effect, or whether both may not be the outcome of other factors.

It will be instructive therefore to approach the subject from a different angle and enquire into the heredity of the victims of alcohol in order to find if they show any traces of nervous derangement which may have disposed them to the excessive use of drink. Dr. Branthwaite has furnished evidence that about two-thirds of the inmates of the Inebriate Reformatories of England and Wales were mentally defective. The data collected by Dr. Branthwaite together with other data obtained elsewhere have been subjected to a statistical investigation by Barrington, Pearson and Heron in their *Preliminary Study of Extreme Alcoholism in Adults*. A *Second Study* on the same subject based on additional material was published two years later by Heron. The general conclusion of these writers is that extreme alcoholism is a symptom of pathological inheritance. Victims of chronic alcoholism which is sufficiently severe to lead to segregation in a reformatory show, as a class, a relatively high degree of mental defect, emotional instability, and poor education. Heron remarks, in speaking of the female inebriates studied by him, although most of his statements apply equally well to the other sex, that "A large propor-

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tion of the women begin to drink practically at the earliest age at which they can obtain access to alcohol, and the amount of mental defect among those who have been drinking for many years is only slightly greater than that among those who are at the beginning of their alcoholic career. There is a close relationship between the intensity of alcoholism and the mental conditions of the inebriates but no relationship with their physical condition. All this lends support to the view that the mental defect of the inebriate is not a gradual growth; it is born, not bred; that inebriety is more an incident in the life of the inebriate than the cause of his mental defect."

This conclusion which is coming to be quite widely adopted receives strong support from the investigations of Stöcker which are described in his book on *Alkoholpsychosen*.[1] Stöcker was a physician in the psychopathic clinic at Erlangen, Germany, and he endeavored to follow up the histories of the various cases of alcoholic delirium that were confined in the institution. He went into the homes of the patients wherever possible, got into friendly relations with their families, and obtained whatever information he could regarding the early life of the patients and especially any symptoms of disordered mentality they may have manifested previous to their use of alcohol. At the same time he informed himself as fully as possible concerning the ancestry and other relatives of the person in question. Stöcker was able to get fairly complete data in regard to ninety of the hundred and fifteen cases represented in the asylum. Thirty-four of these cases had more or less regular fits of epilepsy, and in all but two of these the author found epileptic symptoms before the patients started to use alcohol in excess. In the vast majority of the remaining cases including chronic alcoholic mania, dementia præcox and other disorders there was a history of nervous or mental derangement before the alcoholic habit was acquired. And in most cases also there was a neurotic taint in the parents or other near relatives. But the point that seems evident from the data is that these victims of alcoholism were not so much deranged because they

[1] G. Fischer, Jena, 1910.

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were alcoholic, but they became alcoholic because they were previously abnormal. It may be said that they were born abnormal because their parents were addicted to alcohol. But if we were to enquire into the history of the parents the same question would arise: Were they alcoholic because they were degenerate or degenerate because their parents were alcoholic? And so we might go back generation after generation and we would probably find much the same conditions that prevail in the stock at the present time. The question of paramount importance is: What started the neuropathic strain of alcoholics in the first place? Presumably it started somewhere from a relatively normal stock. Was the start due to alcohol? This is of course posssible; we may say that it is not improbable. But proven it is not. And it cannot be proven by the kind of statistics usually appealed to in support of the commonly received opinion. Most of these statistics are drawn from institutions for the care of epileptics, insane asylums, homes for the feeble-minded, and institutions for the care of chronic inebriates or dipsomaniacs. From the nature of the case we are dealing with a portion of the population with a defective inheritance which may manifest itself in many ways. Medical authorities are of the opinion, generally speaking, that the tendency to drink is an inherited one. And this strong tendency to drink is very frequently accompanied by, and is perhaps a result of a neuropathic taint. As Dugdale says in his book on the notorious Jukes family, "fuller investigation tends to show that certain diseases and mental disorders precede the appetite for stimulants and that the true cause for their use is the antecedent hereditary or induced physical exhaustion."

If we could start with two lots of people of equally good inheritance and allow to one the use of alcoholic stimulants and withdraw them from the other, and then after a few generations compare the average progeny of the two lots, we might, after making allowance for the differences of direct environmental influence affecting the children, arrive at some probable conclusions as to how alcohol influences heredity. We do not find these

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conditions realized to any considerable degree. However, there has been found little correlation between the amount of drunkenness in any city or country and the number of defective people. Dr. Bevan Lewis and Dr. Sullivan have shown that in England the inland or agricultural communities had the least amount of drunkenness and a high ratio of pauperism and insanity, while mining and manufacturing communities which were the most intemperate had a very small ratio of pauperism and insanity. This fact, while contrary to what one might expect in the light of the fact previously cited, may not be indicative of anything in regard to the hereditary effects of alcohol. The better endowed may have migrated into the cities, leaving the poorer stock to perpetuate the race in the country, and there may have been various other social forces that would work in the same direction. The situation illustrates how dangerous it is to take statistics at their face value, and to base conclusions on them without a knowledge of the various possible factors which may account for the results.

One of the most systematic investigations of the subject that has appeared in recent years is the *Study of the Influence of Parental Alcoholism on the Physique and Ability of the Offspring* written by Elderton and Pearson, and published by the Eugenics Laboratory of London. The material investigated consisted of a school in Edinburgh and some special schools in Manchester. The parents of the school children were carefully studied and their habits as regards alcohol accurately ascertained. In the data from the Manchester schools the parents were classed as either temperate or intemperate, but a closer grading was made of the Edinburgh parents who were grouped into teetotalers, sober, suspected to drink, drinks, has bouts of drinking. The children were graded as to height, weight, health, eye-sight and mental ability. Then a comparison was made between these characteristics and the habits of the parents. It was found (1) that in both Edinburgh and Manchester there was a higher death rate among the children of the alcoholic parents, and that the alcoholic parents had more children, so that the net family was about the

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same in the two classes. (2) The mean weight and height of the children of alcoholic parents were slightly greater than the weight and height of the children of the sober parents, but as the age of the former children is slightly greater, the correlations when corrected for age show a slight advantage in favor of the children of the sober. (3) The general health of the children of the alcoholic parents appears a little better than that of the children of the sober, perhaps because the more delicate children of the former died to a greater extent in infancy. There was actually more epilepsy in the children of the sober. (4) The vision was slightly better in the children of the alcoholics. (5) The intelligence of the children from the two classes of parents was so nearly the same that the difference was not significant.

Although these results were based on a study of over a thousand school children, it is quite possible that fuller data would establish a different conclusion. The outcome, as Elderton and Pearson admit, was quite contrary to what one might reasonably expect, and it naturally evoked considerable criticism. Most of the criticisms were beside the mark and were successively met by the different replies which were made by Pearson and Elderton and by Pearson. Without entering into a discussion of the several points raised in this more or less acrimonious controversy, mention may be made of two objections which were much stressed by the critics of the memoirs in question. It was urged that the portions of the population dealt with were not representative of the people at large, and hence any conclusions drawn from the investigation would be of no value. The Edinburgh population, according to Saleeby, consisted of "the slums in the North Canongate," although a list of the trades represented by the parents showed a fairly typical series of occupations for the working classes. In the Manchester school "one child in each family, whether the parents were temperate or intemperate, was mentally defective." In view of the strong hereditary character of mental defect, it is very probable that the Manchester parents represent a selected group rather strongly tainted with hereditary disability.

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But granting these groups dealt with are not representative of the general population, this fact is irrelevant, as Pearson has urged, so long as it has not been shown shown that for each group the alcoholic and non-alcoholic parents do not belong to hereditarily differentiated classes. Pearson claims that his critics have not shown that this is the case, and he has furnished evidence that so far as wages and choice of trades are concerned, there is no marked difference between the alcoholic and non-alcoholic sections. It may be urged, *a priori*, that if a group which works against a handicap of alcohol attains an efficiency equal to that of another group not so handicapped, the former must be the better hereditary material, but we have no statistical proof of this in the present case.

Where we are dealing with the parents of defective children, as in the Manchester data, there is of course the possibility, especially in the light of the experiments of Stockard, that the sober parents produce defective children because they are of defective stock, while a part of the alcoholics do so because they are alcoholic. These possibilities are mentioned not as a criticism of the memoir in question, but as showing the extreme difficulty of solving biological problems which are complicated by so many social factors. As the studies of extreme alcoholism have shown, extreme alcoholism itself serves to distinguish biologically one class from another. In view of the graded character of mental defect at what point does alcohol cease to have this segregating effect? An occasional or moderate use of alcoholic beverages is perhaps no more indicative of mental peculiarities than being a teetotaler, if as much. But as the use of alcohol increases it comes to be more of a mark of a hereditarily defective stock. It is not improbable that, as Pearson suggests, the parents of the Edinburgh and Manchester school children failed as a rule to develop that degree of alcoholism which is associated with mental defect. The apparent discrepancy between the results of the *First Study* and the *Studies on Extreme Alcoholism* is explained on the ground that "the mentally defective became *extreme* alcoholists, inebriates in constant conflict with the police because the mental de-

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fect is antecedent to their alcoholism. But because the bulk of the mentally defective became criminal or alcoholic it does not follow that every alcoholist is mentally defective, and will breed mentally defective children."

Another objection to the conclusions of Elderton and Pearson is that in no case was it certain whether or not the parents began their alcoholic habits before the birth of the offspring. It is a fair presumption, from what is known of the persistence of habits in human beings, that the parents who were alcoholic after their children became of school age were in most cases more or less alcoholic before their children were born. Of course the alcoholic habits of people are subject to much variation, and some parents may have used alcohol before their children were born and afterward became sober, and in other parents the alcoholic history may have been just the reverse. To the extent that such changes occur, whatever correlations may exist between parental alcoholism and the characteristics of offspring would not be revealed by the statistical methods employed. The presence of fluctuations in the alcoholic habits of parents would naturally weaken the correlations that might exist between alcoholism of parents and peculiarities of their children. These correlations would be further weakened by the fact that the classes compared were not as sharply defined as would be desirable. The teetotalers were unfortunately very few in number and for statistical treatment they were usually grouped with the sober or those who drank but little. For the same reason the small group of those "suspected to drink" were combined with the drinkers.

The investigation of Elderton and Pearson is of a type that it is desirable to see extended to further data. If the results do not justify a final verdict,—and the authors make no sweeping claims for the general applicability of their conclusions,—the fault lies in the inherent difficulty of the problem rather than in the imperfections of the methods employed. The authors set about investigating a particular set of data bearing on a most important problem, and they stated their precise findings and some conclusions that could and some that could not be drawn from their data. If

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the authors obtained mainly negative results it is unscientific to berate them for this fact, or to bewail the circumstance that their findings may have given comfort to the friends of alcohol.

We may pass briefly over the studies of Laitenen, MacNicholl, and Bezzola since they have subjected to a critical overhauling by Pearson and shown to be based on faulty methods of investigation. Laitenen's data do not inform us whether the father or mother or both parents were alcoholic, which is a very unfortunate omission when one is dealing with problems of heredity. Weights of the children of abstainers, moderate drinkers (those taking no more than a glass a beer a day) and drinkers were taken by the parents at monthly intervals from birth to eight months of age. The babies of the drinkers averaged somewhat less (4.4 per cent for boys, 3.6 per cent for girls) than those of abstainers, the offspring of "moderates" occupying an intermediate position. Although when eight months old the abstainers' children were heavier than those of the moderates, and these again heavier than those of the drinkers, increase in weight, however, was quite as rapid in the children of the drinkers when comparison is made with the original weight. These results have very little significance for any problem of heredity since we know little of the social and nothing of the racial differences of the several classes. The fact that the age at marriage for the abstainers is considerably greater than that of drinkers might, since young mothers produce small babies, be a factor in accounting for the relatively slight differences in weight between the offspring of the drinking and abstaining parents.

Bezzola contends that relatively more idiots and imbeciles are conceived in Switzerland during the period of vintage and at other times at which unusual amounts of alcohol are drunk, but as the excess at most is only three births out of some seven hundred it is entirely without any statistical significance.

MacNicholl's data, despite its imposing quantity, yields no evidence of the rôle of heredity which any critical student of genetics would think of basing any conclusions upon. Maternal or paternal inebriety are not distinguished, and no attempt is

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made to separate the effect of the children's use of tobacco and liquor, which he claims are deplorably prevalent, from the effects possibly due to heredity. The papers of MacNicholl belong to that very large class of literature on the hereditary influence of alcohol which neglects nearly all of the elementary precautions which are absolutely essential for attaining reliable results.

From the kind of data we have on the hereditary effects of alcohol in human beings it is difficult to come to any positive conclusion. And there is a much less confident tone in the utterances on this subject among more recent authorities on heredity than there was several years ago. It is commonly recognized that in certain families there is a bent toward alcoholism. This no more proves that such a trait is the result of the liquor habit than the reappearance of kleptomania proves that this failing is the result of parental thieving. What caused the original appearance of the bent toward alcoholism we do not know. Neither do we know in most cases what causes the first appearance of feeble-mindedness and the hereditary forms of epilepsy and insanity. When the attempt is made to follow the history of these maladies we usually uproot a strain of defective inheritance which runs back and back farther than we can trace it. The Jukes, the Tribe of Ishmael, the Kallikak family, the Zero family and the Nam family all have much the same melancholy sort of history. All show alcoholism and degeneracy going hand in hand. It is reasonably certain that much alcoholism is the product of degeneration. That it is a common cause of the first appearance of degenerate strains is of course possible, if not probable. But our present knowledge of the subject does not justify us in asserting that such a conclusion is anything more than a good working hypothesis.

There is no question in eugenics more important than that of the origin of defective strains of human beings. How much light might be thrown on the problem by statistical investigation, if undertaken in the right way, I shall not presume to predict, but so far as the hereditary influence of alcohol is concerned the most promising method consists in experiments on animals. In this

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way conditions may be controlled, check experiments carried on, and data obtained that are free from a multitude of possible interpretations. Heredity in human beings is essentially the same as heredity in animals, and should it be found quite generally that alcoholism in the lower animals is productive of heritable defects, it is very probable that the same conclusion could be applied also to man.

The only other substance which evidence points to as probably causing injury to human germ plasm is lead. In 1860 Constantine Paul reported that women workers in lead have an unusually high number of abortions, stillbirths, and children who are unhealthy and die early. Much more indicative of a true hereditary influence is the fact that, when the father alone worked in lead a high percentage of abortions or early deaths occurred in the offspring. Of 32 pregnancies in women who were not lead workers but whose husbands were exposed to lead there were twelve abortions or stillbirths, and of the 20 children born alive, 8 died in the first year, 4 in the second and 5 in the third.

The bad effects of plumbism have been discussed by several writers (Ballard, Lewin, Rennert, Bourneville, Roques, Oliver) but in most cases the reports dealt with maternal plumbism, or with data in which the maternal and paternal effects are not distinguished. It has been shown that lead is absorbed by the fœtus from the mother and that it may also pass to the offspring through the mother's milk. In maternal plumbism, therefore, the offspring are doubtless directly injured by the lead itself.

Even when women who have discontinued work in lead continue to have an unusually large number of abortions the result may be due either to persistence of the poison in the mother's blood, or to the general impairment of their health as a result of the poison.

According to Oliver, "the effects of lead in this particular direction [*i. e.*, on offspring] are worse when both parents are affected, next when it is the mother alone who has been brought under the influence of lead; but there is evidence to show that lead impregnation of the male is extremely prejudicial to the

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offspring. Rennert has attempted to express in statistical terms the varying degrees of gravity of the prognosis of cases in which at the moment of conception both parents are the subjects of lead poisoning, also where one alone is affected. The malign influence of lead is reflected upon the fœtus and on the continuation of the pregnancy 94 times up to 100 when both parents have been working in lead, 92 times when the mother alone is affected, and 63 times when it is the father alone who is working in lead. . . . In his studies upon hereditary degeneration and idiocy, Bourneville places house-painters in the unenviable first rank of the occupations followed by parents of mentally weak children." (*Diseases of Occupation*, 202–203.)

These results, while not very conclusive as to permanent injury to the germ plasm, are naturally suggestive of such action. The possibility of true heritable modification being produced by lead has been tested by Cole and Bachhuber [1] on fowls and rabbits and by Weller on guinea pigs. Cole and Bachhuber administered lead only to the males. The offspring of the poisoned male rabbits showed less weight and a higher mortality than the offspring of normal individuals. In the fowl it was found that eggs fertilized by poisoned cocks failed to develop much more frequently than those fertilized by normal males, and the chicks from poisoned male parentage had a higher mortality both before and after hatching.

Weller found that the offspring resulting from mating poisoned male guinea pigs with normal females were about 20 per cent less in weight than the controls, that more of them died during the first week and that the survivors showed a general retardation. Thus far we are not in possession of facts indicating that injury due to lead is carried beyond the first generation. If the results of male plumbism are due to injuries to the chromatin material of the sperm cells it seems probable that they would be transmitted to subsequent generations. Analogy with the effects of male alcoholism in guinea pigs would also support this conclusion. Further work on this important problem is much to be desired.

[1] Proc. Soc. Exp. Biol. Med. 12, 24–29, 1914.

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It is important to carry experiments through several generations and to experiment with a large number of substances and upon a variety of forms of life. If we knew the conditions under which new variations arise in plants and animals the information would not only be of great importance in relation to problems of heredity and evolution, in general, but it would be of especial value to the student of the trend of our own racial development.

The evidence that the toxins of disease may unfavorably affect the inheritance of human beings is at present very inadequate. In the light of such facts as have just been discussed such an influence would seem probable *a priori*. The disease whose hereditary effects are the most obvious is syphilis, which may be transmitted from parent to offspring through one or two generations and possibly more. It is not necessary to describe the disastrous consequences to offspring resulting from this terrible malady. It is only too well known as a very potent cause of abortions, stillbirths, early deaths, and much misery to those to whom it does not mercifully prove fatal. The transmitted effects of parental syphilis, however, are mainly due to the infection of the offspring by the organism, *Spirochæta pallida*, which is now demonstrated to be the cause of this disease. Whether syphilis produces a true blastophthoric effect is a matter very difficult to ascertain, because such an influence would be so closely associated with the direct results of the disease itself. There is no evidence at present available which would warrant us in regarding syphilis as the cause of defective inheritance in the proper significance of this term.

The same conclusion may be drawn for tuberculosis, malaria and other diseases which are often rather loosely spoken of as "racial poisons." It may be more or less probable, *a priori*, that they may permanently impair human germ plasm and give rise to strains with a degenerate inheritance, but our knowledge on this important problem is still too meager to justify positive statements.

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CHAPTER XIII

THE ALLEGED INFLUENCE OF ORDER OF BIRTH AND AGE OF PARENTS UPON OFFSPRING.

Our information on the subjects treated in the present chapter is in a most unsatisfactory state. It is with some hesitation that I have ventured to discuss them at all, but on account of their importance for the general problem of human evolution it was thought that it might be useful to treat them briefly, even though little more was done than to exhibit the imperfections of our knowledge and to point out some of the pitfalls into which the unwary have so frequently fallen.

In regard to the influence of order of birth upon offspring there is one conclusion which we may feel warranted in drawing with some confidence. The first born children are apt to be lighter in weight and shorter in height than those of later births. Nothing is involved in the establishment of this conclusion beyond the collection and comparison of data on the weight and size of newly born infants and there is no reason to doubt the generality of the conclusion just expressed. Dr. Matthews Duncan gives the following data on the weights and lengths of infants according to the order of their birth:

Birth Rank	*1*	*2*	*3*	*4*	*5*	*6*	*7 and over*	*Average*
Weight in lbs.....	7.20	7.31	7.35	7.19	7.45	7.32	7.31	7.26
Length in inches.....	19.20	19.24	19.30	18.96	19.27	18.96	18.99	19.19

Pearson submits the following table on the weights of 2,000 babies, excluding twins and illegitimate births, from the records of the Lambeth Lying-in Hospital:

Birth Order	*1*	*2*	*3–4*	*5–6*	*7–8*	*9–10*	*11 and over*	*Mean Weight*
Boys.....	7.01	7.36	7.41	7.70	7.91	7.59	7.92	7.40
Girls.....	6.76	7.08	7.33	7.36	7.32	7.65	7.88	7.15

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The lengths of the same series of babies were found to be as follows:

Birth Order	*1*	*2*	*3–4*	*5–6*	*7–8*	*9–10*	*11 and over*	*Mean Length*
Boys	20.62	20.82	20.80	20.95	20.98	20.99	21.14	20.81
Girls	20.27	20.33	20.51	20.43	20.36	20.41	20.73	20.38

These sets of tables,—and there is considerable additional evidence to the same effect,—indicate that the first born infants of both sexes are lighter in weight and shorter than the second born, and that there is a general increase according to order of birth until near the close of the child-bearing period. The reason for the relatively small size and weight of the first born may lie in the fact that the mothers are, on the average, young, and also in the circumstance that their organization is not so well adapted to child bearing as it becomes after one or more births. It is well known that the first birth is usually the most difficult. There is a relatively larger number of stillbirths among the first born. Taking the records of 48,843 births among the professional and upper classes, Ansell found the proportions of stillbirths distributed as follows:

Order of Birth	*1*	*2*	*3*	*4–6*	*7 and over*
Still births per 1,000 born alive	40	20	15.5	17.4	20.9

According to Ansell there is a greater mortality among the first born in the first year of life. From the records of the 48,843 births just mentioned he obtains the following data:

Order of Birth	*1*	*2*	*3*	*4–6*	*7 and over*
Deaths in 1st year per 1,000 living births	82.2	70	69	78.3	97.4

Additional evidence in the same direction is furnished by Pearson from the records of the artisan classes from several

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English towns. The following table gives the death and delicacy rates of 3,000 babies born in Bradford:

Order of Birth	*1*	*2–3*	*4–5*	*7–6*	*8–9*	*10–11*	*12+*
Death rate in 1st year.....	16.2	12.4	13	14.3	17.4	17.7	33.3
Delicacy rate in 1st year....	3.9	4.2	5.7	6.5	6	8.3	9
Both combined.....	20.1	16.6	18.7	20.8	23.4	26	42.3

Data from births in Sheffield yield closely parallel results:

Order of Births	*1*	*2*	*3–4*	*5–6*	*7–8*	*9–10*	*11–12*	*13+*
Total births.....	636	691	1156	843	518	334	143	101
Death rate in 1st year per 1,000 births	12.9	11.6	11.5	10.6	12.6	16.2	11.9	24.8

All of these results show that the death rate of infants is relatively high for the first born and that it tends to decrease successively with the second and third and sometimes the fourth or fifth born, after which there is a rise in the death rate which is particularly high after the birth of the twelfth or thirteenth child.

That the greater mortality of the first born is due to the same causes which give rise to reduced size and weight is a conclusion which, although having a certain amount of plausibility, it would be rash to adopt, at least as an explanation of the whole difference between the death rate of first and later born children. The first born would naturally suffer more from the ignorance and inexperience of their mothers and there are other factors which would affect unequally the various children of a family. Biological and social factors may both affect the death rate of the first children of a family, and it is a matter of great difficulty to assign to each its proper rôle. Whatever may be the reasons why the first born are handicapped in the first year of life, it is of much interest to ascertain if this handicap persists in later years. Pearson and some of his co-workers have maintained that this initial disadvantage is correlated with a greater liability to tuberculosis, insanity and other afflictions of adult life. As an illustration of the method

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employed by Pearson and his colleagues we may consider the *First Study of the Statistics of Pulmonary Tuberculosis* which gives data on the order of birth and size of family of 381 tuberculous patients from the Crossley Sanitorium at Frodsham, England. The assumption was made,—which could not be far from the truth—that only one patient was drawn from a single family, and since there were 381 families represented, each of which must have contained a first born member there must have been 381 individuals among the families represented who were first born-children. Since the size of the families was ascertained the numbers of second, third and subsequent born could readily be calculated. If we divide the tuberculous patients in the first, second and third born, etc., in the same ratio in which these classes occur in the members of the tuberculous families in general, we obtain a series of numbers which may be compared with the members of first, second, third, etc., born among the tuberculous patients which were actually found. The following table gives the expected frequency of tuberculosis patients and the actual frequency in the groups representing the various orders of birth:

Order of Birth	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*Over 14*
No. of cases observed. .	113	79	41	52	39	18	18	9	3	3	3	1	1	1	0
No. of cases calculated. .	67.1	64.4	58.5	50.9	43.5	32.6	22.2	15.1	10	6.2	3.7	2.6	1.6	1.1	1.6

The table indicates a great preponderance of the tuberculous among the first born. Comparisons of the distribution of tuberculous patients with the relative proportions of first, second and subsequent born among the population of New South Wales showed the same excess of the tuberculous among the earlier born individuals.

Dr. Heron has come to the conclusion that insanity is especially prone to attack the first born members of a stock. In Goring's

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excellent work on *The English Convict* it is claimed that criminality develops in the first born to a much greater extent than it does in the later born members of the stock from which the criminals are derived. Pearson confirms the deductions of Heron and Goring for insanity and criminality, and he has adduced data to show that the first born are unusually liable to albinism, imbecility, epilepsy and cataract.

A number of writers have attacked the findings of Pearson and his colleagues on the ground that they are based upon a statistical fallacy. Greenwood and Yule have arrived at a quite different ordinal distribution of the relative number of individuals in the members of the families of the marked individuals. When we are dealing with cases of insanity or tuberculosis in which we start with individuals, say in institutions, it is obvious that all members of the marked person's family are not equally apt to be found in the segregated class. There is an age at which insanity and tuberculosis is more than likely to appear and the chances are decidedly against two persons from the same family being confined at the same time, there being an especially strong bias against the members who have not reached adult life. Recently Pearson's methods have been attacked by Dublin and Langham of the Statistical Bureau of the Metropolitan Life Insurance Company of New York. These authors contend that Pearson's method "is based unequivocally on the assumption that the distribution according to order of birth of the pathologic community from which his 'marked' or affected subjects are obtained is identical with the distribution of the sibships of these subjects. For if that be the case he can use the distribution of the sibships of the affected as a norm in comparing with it the distribution of the affected, in the effort to show that actually the early born among his subjects preponderate beyond all expected proportions. We shall endeavor to show that, when there is no weighing according to order of birth among the individuals affected, the distribution of the affected or that of the pathological community represented by them is not in any case comparable with that of their sibships. We propose to take the distri-

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bution of a normal population, and, supposing all members of it to be liable to some disease in equal proportions, obtain from it the distribution of the sibships of the affected by order of birth which is to be expected on the assumption made. We shall find that the distribution of the sibships is by necessity so different as to account for practically the whole difference found by Pearson."

Here we have differences of opinion among statistical experts regarding a purely mathematical problem, quite apart from any biological or social factors which may possibly be involved in it. Dublin and Langham have arrived at precisely the same theoretical distribution of 381 tuberculous patients as Greenwood and Yule found. The statistics show that there is still a preponderance of first born among the tuberculous, but it is so much less than that estimated by Pearson that the authors do not consider it especially significant.

Pearson has replied to Greenwood and Yule—and his argument would affect the criticisms of Dublin and Langham also—claiming that their method, when applied to the kind of material which is investigated leads to incorrect results. We shall not attempt to enter upon a discussion of the details of the mathematical questions which are the subject of controversy. There is occasionally a surplus of first born over the expectation as estimated by the methods of Greenwood and Yule as is the case with tuberculosis, criminality and insanity. Characteristics found to occur frequently in small families will naturally be found in a relatively large percentage of first born offspring. As Pearson remarks, "Certain types of parental degeneracy seem incapable of producing more than one or two children at most, and the children of such parents are themselves feeble. But, if any small families are thus selected, we shall increase the number of early-borns in the diseased population, for such small families have no late-borns."

It may very well happen that the first-borns may be relatively abundant in a diseased or defective stock, although they may not be relatively less frequent among the sibships of the affected stock

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than among the affected persons themselves. This would be the case if the affected families were small. It is very desirable to have data on the relative position of the affected person in individual families of two, three, four, five, etc., persons so that it could be ascertained whether or not within the limits of families of a given size the marked individuals occur in preponderating numbers in any given position. Data grouped in this way would enable us to avoid several pitfalls incident upon handling mass statistics. In the data of Weeks on the order of birth of epileptics there is, as Pearson states, "no excess of the eldest-born in the individual families; if there be any excess it is in the intermediates. Thus, if we may trust this data, which are slender, there is no weighting of the first-born in the case of epilepsy unless it arises from the weighting of small families." Treating the data by the methods employed in other cases Pearson finds an excess of epileptics among the first born. "We must, I think, conclude," he remarks, "by recognizing that, while there is a weighting in epilepsy, this is due to a selection of families rather than to a selection of the elder-born in each family." How far the relatively large proportion of first-borns in Pearson's data on other defects may be due to the selection of small families is, of course, uncertain. It is of value to know, however, whether the relative preponderance of the first born in pathological stocks is due to the smallness of the family. As Pearson remarks, "We are shooting, so to speak, at the entire population of first borns, and a bias with regard to selection of weaker families may come in, in much the same way as families up to six or seven may be the sign of healthy parents, and so the offspring will be less liable to disease. This idea cannot be excluded. But in itself it indicates how inadequate is the proposal to treat the problem only within families of constant size."

However it happens that the first born in the population in general comes to be selected for defect or disease, the reduction of the size of families leading to an increase in the relative proportion of first born individuals will inevitably cause an exaggeration of several undesirable hereditary traits. In so far as the birth

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rate is allowed to take its natural course large families offer some evidence of physical vigor whatever they may indicate as to mentality. A general reduction of the birth rate has, therefore, its dangers, at least for the physical vigor of the population, since it would probably involve a greater proportionate reduction of healthy and vigorous stocks.

It would indeed be unfortunate if a reduction of the birth rate in the larger families would lead to the reduction of the best members of the stocks in addition to the loss of physical vigor otherwise involved. Whether ordinal position in the family except in the matter of weight, size and infantile death rate, is *per se* a handicap is a question which most of our data do not enable us to decide. The fact that there is a greater percentage of deaths among the first born than there is among the second or third born does not prove that the second or third born member of any particular family is less likely to die than the first born. The large percentage of deaths among the first born may be due to the fact that a large proportion of early deaths occur in families containing only one or two children. The data do not prove that in families in which three or four children are born the later children have any greater expectation of life than the first. As we have already pointed out fecundity is correlated with longevity. Families limited by the early death of one or both parents would naturally show a high death rate on account of the probability that the offspring would inherit a diminished vitality. On the other hand, large size of family very commonly has a very undesirable relation to infant mortality, despite the vitality of the stock from which large families come. This is due in part at least to economic causes and in part to the correlation between mental subnormality (this does not imply reduced physiological vigor) with a high birth rate. Where large families occur among intelligent and thrifty people as they did a century ago, there is much less correlation between size of family and a high early death rate. The following table from data collected by Dr. A. G. Bell is instructive in this connection:

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Relation of Duration of Life to Size of Family

Number in family	*Total persons*	*Percentage dying at age groups indicated*				
		Under 20	*20–40*	*40–60*	*60–80*	*80+*
1	41	58.5	22.0	4.9	9.7	4.9
2	85	42.4	24.7	18.8	9.4	4.7
1 and 2	126	47.6	23.8	14.3	9.5	4.8
3 and 4	313	36.1	25.5	19.2	14.4	4.8
5 and 6	584	35.5	24.5	18.3	15.9	5.8
7 and 8	694	33.0	25.2	17.7	16.9	7.2
9 and 10	683	32.8	22.2	17.9	17.4	9.7
11 and 12	396	33.6	21.2	18.4	17.9	8.9
13 and more	168	46.4	17.3	13.1	17.3	5.9
	100.0%	35.2%	23.4%	17.7%	16.4%	7.3%
	2,964	1,044	693	525	486	216

The table deals with 2,964 members of the Hyde family of America and is noteworthy in showing the high early death rate among families with but one child, and a gradual decrease of early death rate with increase of family up to families of eleven or more children. There is also a marked increase in the percentage of offspring living to advanced ages (60+ and 80+) as the families become larger in size. The poor showing of the very largest families may be due to causes which have been already discussed. Miss Elderton has remarked that the high death rate among the early born in families or twelve or more "largely disappears if we exclude mothers of bad habits."

Data on the problem whether the first born are handicapped by the mere fact of their ordinal position in the family are very inadequate. Dr. Chase studied the physiques of 58 sets of brothers who entered Amherst College and found that the first born were strongest in four cases, the second born strongest in twelve cases, the third born strongest in twenty-eight cases. The students entered college at about the same age and were tested in the same way, but the small number of cases handled makes it unsafe to draw general conclusions. Pearson found that within

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families of a given size the first and second born show as a rule a preponderating amount of albinism, criminality and tuberculosis. Mongolian idiocy was found to characterize in a rather striking manner the *last* born of the family.

When we investigate the incidence of any quality in regard to order of birth in individual families we are not entirely free from statistical pitfalls, if we start with material segregated in institutions. If we take individuals of a certain age, say 20, which are confined in a sanitorium, then if the numbers of families are increasing in the population at large the individual will be more apt to be the eldest of a recent family than the younger member of an old family. This possible source of error was pointed out by Mr. Cobb who says:

"It has hitherto been assumed that if a person of given age is selected at random from amongst fraternities of a given size then all positions in that fraternity are equally likely. But this is not the case. If the number of births has been increasing he is more likely to be one of the older members of his fraternity, and if the number has been decreasing he is more likely to be a younger member. For while the number of births is increasing there are more children born every year who belong to the first half of their fraternities than who belong to the second half."

In most countries there are more births per annum than previously and a steady increase in the number of families. But granting that this would give us an apparent increase of the first born of any particular age there is a compensating tendency brought about by the declining birth rate. Along with an increasing number of people there has been a reduction of the percentage of the later born owing to the increasing restriction of the size of the family. Consider a random group of 20 year old individuals from families of twelve members. Will not this be more apt to represent the last members of the old families than the first members of families that were started later. Suppose that of the families starting in 1825, one in ten contained a twelfth child, which lived for 60 years. Suppose also that of the families starting in 1875 only one in one hundred had a twelfth

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child that lived for 35 or more years. Now, suppose that in 1910 we select a group of individuals from the families of twelve in the population. It is obvious that our group would contain many more of the twelfth born from the old families than from the later ones. It is evident from these considerations that when we simplify the problem of handicapping the first born by considering the ordinal position of the marked member within families of a particular size, we do not avoid all statistical pitfalls. Our data collected by the methods generally employed would be affected by increase of population and decline of the birth rate, to say nothing of other possible factors.

Mention may be made of one circumstance which might make a real difference between the first and subsequent members of a family,—and that is inherited syphilis. It is a well-known fact that the early born are most seriously injured by this disease. The not uncommon history of a syphilitic family is first the occurrence of one or more abortions, then the birth of weakly children and finally the production of children who are comparatively healthy. The inclusion of any considerable number of such family histories would tend to cause the first born to occupy an unenviable position. Since syphilis predisposes the patient to tuberculosis there would tend to be an exaggeration of the latter disease and probably also insanity and other pathological defects among the early born.

So far as pure heredity is concerned we should naturally expect the first born to have the same endowments as the subsequent members of the family. Primacy of birth as Auerbach remarks is "Kein vererbungstechnischer Begriff." Whatever effects may be due to maternal immaturity or the difficulties incident upon bearing the first child are to be regarded as somatic phenomena which there is no reason to believe produce any inherited effect. How long it takes for initial handicaps which are observed to preponderate in first born children to be outgrown, or whether they are ever outgrown, we are unable to decide.

Those who occupy the position of first rank in their families

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may take comfort in the fact that their claims to superiority are not without their champions. Indeed some of the papers of which Pearson is a joint author suggest that in some respects the first born may have an advantage over their successors. Beeton and Pearson in their investigation of the age at death of over 1,000 pairs of sisters and brothers found that the earlier born had on the average a longer life. The ages at death were as follows:

	Elder	*Younger*
Sisters	59.924	55.667
Brothers	58.560	54.575

The study was based on the longevity of adults who have reached maturity, thus eliminating the effect of infant or child mortality. In a study of 1,051 pairs of brothers and 733 pairs of sisters where it was possible to ascertain the interval between the births it was found that the greater the interval the less is the expectation of life of the younger member of a pair. "A brother born ten years before another brother has probably seven years greater duration of life; a sister born ten years before another sister has about six years longer duration of life."

This conclusion is not exactly opposed, however, to the doctrine of the inferiority of the first born, especially at birth. As only adults were considered in Beeton and Pearson's studies the earlier born had passed the first ordeals of life and their greater early death rate may have rendered them relatively more hardy than their less stringently selected younger siblings.

In an article entitled "The Long-Lived First-Born" the editor of the *Journal of Heredity* presents a study of longevity according to birth rank of 802 individuals most of whom were over 90 and all of whom were over 80 years of age. A relatively large number, 217 out of 802, or 27.05 per cent of first born children live to be aged; a smaller percentage of aged occur in the second born, 118 out of 786, or 15.01 per cent and a still smaller percentage of aged occur in the third born, 104 out of 765, or 13.59 per cent, the succeeding birth ranks showing only a slight further decrease.

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Of the aged individuals studied there were "some living and some dead." This is an unfortunate circumstance, since it tends to bring an undue relative proportion of the first born in the advanced age group. It is fair to assume, since we have no information to the contrary, that some of the aged had younger siblings who might also have become aged and hence helped to swell the ranks of the later born offspring. Were all the children of the families given time to qualify for the advanced age group it is not at all evident that the first born would be represented in the highest percentage of cases.

It is in the field of intellectual activity that the first born have most often been said to distinguish themselves. The claim is made that the first born are more variable than their successors, and while they produce a larger number of defectives and criminals they also give rise to a larger number of men of genius. Gini has shown that the first born predominate among the professors in Italian universities. The matter was investigated by sending questionnaires to the professors; 445 replies were received of which 416 related to families of two or more. The distribution of the professors according to birth rank may be seen from the following table:

Birth Rank of Italian Professors

Birth Rank	*a* *No. of Professors from Families of 2 or More*	*b* *Expected No.*	$\frac{100a}{b}$
1	141	87.4	161
2	82	87.4	90
3	58	69.9	83
4	45	54.2	83
5	32	38.7	83
6–7	31	44.9	79
8–9	20	19.8	79
10+	7	13.4	52
	416	415.7	

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It is not stated on what basis the expected numbers in the third column were calculated. Granted that these numbers are free from criticism the number of first born is strikingly larger than the expected proportion. Professor Gini is cautious about stating to what extent the superior attainments of the first born depend upon social considerations such as "the desire of parents to see their eldest child occupy a position that will reflect honor upon the family," and various other factors that are in no way related to biological influences.

Galton in his studies of British men of science found 26 eldest sons, 15 youngest sons and 36 of intermediate position. Similar findings for 50 eminent men are reported by Yoder. Havelock Ellis in his study of the birth order of British men of genius gives the following table showing the position of the genius in the family:

Ordinal Rank of Men of Genius in the Family

Size of Family	*Eldest*	*Intermediate*	*Youngest*
2	15	0	12
3	15	6	11
4	10	16	3
5	10	18	7
6	8	20	6
7	15	14	5
8	2	17	4
9	8	7	4
10	5	10	3
11	3	12	2
12	1	10	2
13	1	4	2
14	0	5	2
Over 14	1	9	4

Here again the honors fall predominantly to the first member of the family, but whether the reasons are mainly biological or social remains in doubt.[1]

[1] Confirmatory results are yielded by Cattell's studies of the birth ranks of

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Closely associated with the effect of order of birth upon offspring is the problem of the influence of parental age. This topic has received more or less attention from the time of Aristotle to the present. Various opinions have been put forth with a degree of confidence which is often in inverse proportions to the adequacy of the evidence upon which they were based. The subject is more difficult than appears upon the surface, and, like the one that has just been discussed, presents many pitfalls. Without troubling ourselves with theories which are unsupported by statistical data let us consider some of the more important contributions to the solution of our problem.

With the increasing age of parents there is apparently an increased percentage of abortions and stillbirths if we except the offspring of very young mothers. Data from Paris and Buda-Pest are given in the following table from Prof. Gini:

Relations of Age of Parents to Percentage of Abortions and Stillbirths

Age of Mother	Paris, 1903–1909				Buda-Pest, 1903–1904			
	Legitimate		Illegitimate		Legitimate		Illegitimate	
	Miscarriages	Stillbirths	Miscarriages	Stillbirths	Miscarriages	Stillbirths	Miscarriages	Stillbirths
15–20	5.03	1.72	5.14	2.41	6.25	1.61	6.39	3.11
20–24	4.68	2.37	6.21	2.88	8.05	1.90	11.03	3.73
25–29	5.46	2.62	7.05	3.68	11.42	2.61	10.98	4.37
30–34	6.15	3.51	8.23	3.80	14.09	3.45	9.62	4.95
35–39	7.39	4.33	6.83	4.14				
40–44	6.65	6.07	9.21	5.07	17.49	5.39	8.20	6.61
45 or over	11.77	6.67	8.76	9.49				

Here it is shown that with the exception of some irregularities in the first horizontal column giving the percentage of miscarriages and stillbirths of mothers below 20 years of age, there is a general increase in the percentage of both miscarriages and stillbirths as the age of the mother increases. Both kinds of

American men of science (Sci., Mar. 5, 1917), and by the (as yet unpublished) researches of two of my students.

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mortality are higher for illegitimate than they are for legitimate births. More extensive data on the proportion of stillbirths per hundred births are afforded by the next table:

Mortality of Infants According to Age of Mother

Age of Mother	Austria		Norway		France
	Legitimate	Illegitimate	Legitimate	Illegitimate	
Under 17.....	2.1	4.0	2.09	4.52	6.9
17–20.....	1.7	3.0			
20–25.....	1.9	3.4	1.66	2.97	4.7
25–30.....	2.2	3.9			4.2
35–40	2.8	4.2	2.39	4.86	4.2
40–45					4.3
45–50	3.9	4.9	4.17	10.14	6.9
50+					6.6

Statistics from other localities show much the same trend as those which have been presented. That stillbirths increase in frequency as the fathers become older may be due not to the age of the father but to the fact that the mothers' ages are correlated with those of their husbands. Where the age of the mother is eliminated the offspring of old fathers do not have a much higher ratio of stillborn than those of younger men. There is also an increase of deliveries requiring surgical help as the mothers become older, exception being made again of first births.

The effect of the order of birth is here a complicating factor. First births, irrespective of parental age, show a large percentage of fatalities. This fact accounts for most of the high mortality among the children of very young mothers. The following table from Professor Gini is instructive in showing how the percentage of stillbirths is affected by eliminating the effects of order of birth:

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Table Showing the Influence of the Age of the Mother on Birth Mortality, Eliminating and not Eliminating the Effect of Order of Birth

Age of Mother	Saxe-Meinungen (1878-89) Taking birth mortality when mother is 35-40 at 100, birth mortality at other ages is		Luxemburg (1901-03) Taking birth mortality when mother is 35 and up at 100 birth mortality at other ages is		Berlin (1893-97) Taking birth mortality for all births at 100, the birth mortality according to the age of the mother is	
	Not eliminating order of birth	Eliminating order of birth	Not eliminating order of birth	Eliminating order of birth	Not eliminating order of birth	Eliminating order of birth
Under 20.....	66	32	60	42	57	61
20-25.....	68	42	50	38	73	80
25-30.....	68	54	54	44	83	94
30-35.....	80	77	69	63	97	102
35-40.....	100	100	88	87	120	114
40-45	210	119	123	127	157	128
45 and upwards			150	157	227	165

When the effect of order of birth is eliminated there remains a very considerable correlation between the age of the mother and the percentage of stillbirths. On the other hand, when the influence of maternal age is eliminated there is after the first birth little relationship between birth order and ante-natal mortality.

There is no reason to suppose that these effects of age depend upon influences which may be properly described as hereditary. They may be expressive of changes in the maternal organization rather than any primary differences among the offspring. The same may be said for the relation between age of parents and height and weight of their children. The younger mothers tend to bear the smallest children. When we deal with large numbers of cases it is found that there is a slight increase of height and weight as the age of mothers increases. A part of this is due to the very evident increase of giant births (over 4000 gr.) with increasing age of the mothers. (See Prinzing, *Med. Statistik*, p. 52.) As Gini has shown, the apparent influence of age on the size of offspring is really due mostly to order of birth. "The age of the mother," he says, "has no decisive influence of its own on the dimensions of the fœtus; the increase which is found in these

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dimensions is simply due to the fact that the greater the age of the mother the greater is the number of previous deliveries, and it follows that if the women married as soon as they were capable of bearing children we should expect, with a rise in the fertility, an increase in these dimensions in the fœtuses." (*Problems in Eugenics*, II, 117–18.)

With advancing age of parents there is in general a higher death rate of children in the first year of life. There is, however, a preliminary descent from the earlier ages due probably to the high death rate of the first born. The statistics studied by Ewart show that the infant mortality falls "until the twenty-fourth year is reached and then slowly rises again," reaching its maximum in mothers of over 40 years of age. This is indicated in the following table:

Infant Mortality According to Maternal Age

Age of Mother	*No. of Births*	*Deaths in 1st Year*	*Per 1,000 Births*
Under 19.....	152	26	171
20–24 Inc.....	536	66	132
25–29 "	396	66	166
30–34 "	316	74	170
35–39 "	150	34	220
Over 40 Inc....	36	12	330

After the initial fall the rise in the infant death rate with increasing years of the parents is very striking. Data from New South Wales from 1893 to 1900 dealing with 277,799 confinements show a similar fall to the 20th year of the mother's life, and a gradual rise with later years, the infant mortality of mothers above 40 being over four times as heavy as in mothers of 20. When first births alone are tabulated there is a similar fall until the 20th year is reached, after which there is a rise, as is indicated by the following table based on 56,247 first births:

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Mortality of First Births According to Age of Mother (Gini)

Age of Mother	*Taking Mortality from 19–21 Years as 100, the Mortality of the Respective Ages Becomes*
19 or less	118
20	80
21–22	110
23–24	120
25–26	125
27–28	141
29–34	228
35–39	209
40+	480

It appears to be evident that when we make allowance for the unusual difficulties of the first birth, the increase of infant mortality as the age of the mothers increases is due mainly to maternal age and not to the birth rank of the children. Birth rank *per se* after the first one or two births has little apparent relation to infant mortality.

It is contended that parental age is related not merely to infant mortality, but to mortality of later ages as well. Gini states on the basis of returns from Budapest (1903–08) that the percentage of children who die before the death of one of the parents diminishes with the rise of age at marriage of the father and increases with the rise of age at marriage of the mother when it is more than 20 years. Data from New South Wales also indicate that women who marry later, despite the shorter duration of their marriage and their diminished expectation of life, actually witness the death of more of their children than do women who marry younger. As a very large part of the greater mortality of the children of late married mothers is due to infant mortality it is doubtful how much the later life of the children is really affected. Ewart gives some statistics of the relation between age of the mother and the height and weight of children when they have reached six years of age. The six year old children of very young

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mothers (20 or less) are shorter and lighter than the children of mothers a few years older. In mothers over 25 the height and weight of children diminished with advancing age. A somewhat similar relationship is seen in children at 13.5 years. The data of Professor Ewart, since they deal with only a few hundred cases of mixed stocks, are entirely inadequate to solve the problem of how age of parents affects the offspring in later years. In such an investigation there are several sources of fallacious conclusions. Consider for instance the presence of a number of Italians in the population studied. The Italians are characterized by short stature and they are prone to marry early. The children of young mothers would be apt to include a relatively large proportion of Italian stock. Now if we compare the height of these children in later life with the average height of children of older parents we might be misled into attributing to parental age a characteristic really dependent upon race. Children of older parents are, other things equal, members of larger families than children of young parents. Large families tend to characterize stocks in the lower walks of life in which the surroundings are less hygienic and in which conditions for growth are less favorable than among people with small families. By taking a random lot of children begotten by old parents we should get a proportionately large number of children from large families, especially since the relatively recent reduction of the birth rate has occurred mainly through preventing the arrival of those who would be later born children. Selecting the children of old parents, therefore, incidentally involves also a selection of stocks and to a certain degree also a selection of environments. These sources of erroneous interpretation of statistics,—to say nothing of others—must be borne in mind in the study of our problem.

Mr. Redfield has reported investigations on the influences of parental age on longevity of offspring which led him to conclude that children begotten when their parents are old live longer, on the average, than children who are the product of their parents' earlier years. He has calculated the length of life of all the great men of whom he could obtain a record of the birth

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ranks, and finds that the sons of old fathers live longer than the sons of young fathers. He also studied the longevity of 1,104 persons from families of four or more children who lived to adult life. From these persons "among whom those having high birth ranks were brothers and sisters of those having low birth ranks, it was found that there was a very uniform increase in length of life as birth ranks grew higher," an addition of four years to the age of the father added one year to the life of the child.

In regard to the parentage of great men, Redfield remarks: "It may be argued that the sons of old men are necessarily the sons of long lived parents, while the sons of young men are the sons of both long lived and short lived parents, and consequently cannot be expected to live so long on an average." This objection, while sounding reasonable, Redfield attempts to show is fallacious. In order to do so he selected from the Redfield genealogy "every family which had four or more sons who reached maturity and who did not lose their lives because of war or accident." The average life of the different sons is indicated as follows:

	Eldest Son	*2nd Son*	*3rd Son*	*4th Son*
Years.....	60.85	69.14	69.85	71.14

"There can be no selection in this case," says Redfield, "because the different sons of the family are sons of identical parents, and not sons of different or selected parents."

Despite the plausibility of his contention I cannot feel sure that Redfield has succeeded in avoiding our deceptive enemy, the statistical fallacy. If he has averaged together the ages of sons belonging to fathers of certain age groups without regard to date of marriage or other circumstances, he may have obtained quite misleading results. Young parents marry early and older parents as a class must contain many who married late and whose four children, therefore, belong to the later part of their reproductive period. It is possible to have a number of families in each of which the age of successively born children regularly diminishes and yet when the ages of the children are averaged together there

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would be a regular average *increase* of age according to the order of their birth. Let us consider families of four children the fathers marrying at the ages of 20, 25, 30, and 35. Suppose these fathers, by virtue of differences in inherited vitality, live to the ages of 40, 45, 50, and 55 years, respectively. Suppose also that at intervals of five years each father has a son who lived to be several years older than himself. We may represent the ages of the four fathers A, B, C, and D at the time of the birth of their sons in the upper horizontal column and the ages of the sons begotten at these respective ages immediately below.

A.....	20	25	30	35			
Age of son	40	39	38	37			
B.....		25	30	35	40		
Age of son		45	44	43	42		
C.....			30	35	40	45	
Age of son			50	49	48	47	
D.....				35	40	45	50
Age of son				55	54	53	52
Averages of sons.....	40	42	44	46	48	50	52

In the cases of these four families thus arbitrarily chosen the sons in each family have a diminished duration of life as the age of their fathers increases, but their average ages give an entirely misleading indication of the relation of parental age to longevity of offspring. In our table the older fathers produce the older sons, but the influence of age *per se* is to reduce the son's expectation of life. Of course, the supposition we have made is very artificial and arbitrary, but it will make it clear, I think, that the data which Redfield presents do not necessarily prove his case, or obviate the objection which he admits might plausibly be urged against his conclusions. The arbitrary assumption may be not far from the truth, however, since stocks which marry early, such as unskilled laborers, do not have as great longevity as stocks which, like the professional classes, marry late in life.[1]

The chief thesis of Redfield's book on *The Control of Heredity*

[1] And it must not be forgotten that the decline in the general rate of mortality tends to give the later born members of a family a greater expectation of life.

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is that able sons are predominantly the offspring of fathers who were old at the time of their son's birth or else that the more recent ancestors of the able sons were of advanced age. This general principle, according to Redfield, can only be accounted for on the ground that children inherit the mental power which their parents have acquired. Since older parents have reached a higher degree of intellectual development than younger parents their children, it is held, will consequently tend to be of superior mental ability. To breed a race of high intellectual power early marriages should be discouraged and children should be procreated by parents who have attained their best physical and mental development. "Children of young parents," we are told, "are lacking in physical stamina and mental power. They are reckless, careless, sometimes vicious and frequently drift into drunkenness and crime. From this class comes the principal part of our criminals, paupers and prostitutes."

It is quite evidently an exaggeration to say that the principal part of our criminals, paupers and prostitutes come from youthful parents. People who furnish our supply of these undesirables tend to reproduce early it is true; they also tend to keep on reproducing after the people of superior status have begun to limit their families. There is no adequate reason for concluding that youth of parents *per se* is responsible for the degenerate heredity of the offspring. These people marry early or reproduce young because they are of poor stock; they are not necessarily of poor stock because they marry young.

We may make a parallel statement in regard to the parents of superior men. Redfield tells us that men of ability come from parents who are above the age of the parents of the rank and file of humanity. This is to a considerable extent true of the age at marriage of stocks from which great men are apt to arise. As a glance through such works as Galton's *Hereditary Genius*, Ellis' *Study of British Genius*, Galton and Schuster's *Noteworthy Families*, or Cattell's articles on the *Families of American Men of Science* [1] will show, the parents of distinguished men belong

[1] Sci. Mon, 4 and 5, 1917.

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to a class who marry comparatively late. It does not follow that men attain unusual ability because their parents were relatively mature at the time these men were born. The correlation between ability and parental age is probably due mainly to the later marriages of stocks of superior hereditary ability.

Naturally if ability is a product of parental age we should expect that the later born members of a family would most frequently become distinguished. It is not difficult to amass a considerable number of cases in which this is true. The evidence compiled by Redfield, however, may be offset by the data gathered by Ellis in the *Study of British Genius* to which reference has already been made. The relation of frequency of genius to parental age is given by Ellis as follows:

Genius and Parental Age.

Age of Father	*Under 20*	*20–24*	*25–29*	*30–34*	*35–39*	*40–44*	*45–49*	*50–54*	*55–59*	*60 and over*
No. of fathers...	2	9	45	81	59	44	30	13	8	8
Percentage.....	6	3	15	27	19	14	10	4	2	2

The ages of the fathers of 100 cases of Galton's British men of science were as follows:

Age of father.....	20–	25–	30–	35–	40–	45–	50–
Number.....	1	15	34	22	17	7	4

The average ages of Galton's, Ellis' and Yoder's list of fathers (the latter based on 39 cases) were 36, 37.1, and 37.78 years respectively. These differ but little from the averages of fathers of men of professional and allied classes given by Ansell in 1874, viz., 36.5. Geniuses are evidently not the product of senility to any very considerable degree. Within the several families, so far as our rather incomplete statistics go, actually more of them fall into the ranks of the 1st born (and hence the production of the earlier years of the father's life) than in any subsequent birth rank.

Mention may be made of the studies of Professor A. Marro

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which have often been quoted in discussions of this subject. Among the parents of 456 criminals it was found that both young and old parents produced more criminals than were born from people of maturity (20–40 years). Thieves predominate among the children of young parents while swindlers and those guilty of crimes of violence were more common among the children of parents of over 40 years. Studies of the intelligence of 917 school children in relation to the age of their fathers gave a high percentage with good intelligence from fathers below 25 years. The children of young mothers (21 years or less) were found to produce about as high percentage of intelligent pupils as the children of young fathers. The very superior children, however, were somewhat more frequently born of parents of mature age. Children of old parents made in general the poorest showing. However, the children of old fathers made the best record in respect to conduct at school, but curiously enough the children of older mothers were the worst of all. It is noteworthy that the relation between intelligence of offspring and age of parents is just the reverse of what it is claimed by Redfield, and the relation of crime to parental age seems to be at variance with the findings of Goring who found that criminals were especially frequent among the first born.

There is so much opportunity for social factors to affect such results as were found by Marro that any real biological influence of parental age is not apparent. Grouping of parents into young and old necessarily involves to a certain degree a selection of stock. This circumstance together with the environmental factors which are also more or less different for the children of old and young parents may influence to a considerable degree the intelligence and conduct of school children and even proclivities to crime in later years.

Undue frequency of births is undoubtedly correlated with the high early death rate of children. Data compiled by Ansell from well-to-do English families showed that where the interval between births was less than a year the infant mortality was nearly twice as great as when the interval was between one and

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two years, and over twice as great when the interval was over two years. There was also a slightly greater death rate between the first and fifth years when the intervals between births were short, but the differences were slight. Ewart has adduced data to show that frequent births handicap offspring both physically and intellectually even at six years of age. The initial inferiority of children resulting from too frequent births is probably due in large part to the reduced vitality of the mother. The relatively poorer intellectual development which has been noted (and our data on this score are hardly sufficient to warrant a general conclusion) may be due largely to the selection of stocks. The people who exercise no control over the rapidity of their multiplication are not apt to produce children who excel in tests of intellectual development.

It is uncertain that any of the agencies considered in the present rather unsatisfactory chapter cause any changes that may properly be called hereditary. They may influence offspring, possibly throughout life, but it is probable that their effects are mostly purely somatic. It is possible that parental age, for instance, might influence selective fertilization, or the selective elimination of embryos. Since an old body affords an environment for the germ plasm different in many ways from that afforded by a young body, it is not improbable that this circumstance might be reflected in the trend of germinal variability. It might be conjectured that whatever causes the vitality of our bodies to run down with advancing years might also affect the germ plasm in a deleterious manner. But there is little use at present in indulging in mere conjectures. Experiments on animals may throw light on some of these matters about which we are now in complete ignorance.

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CHAPTER XIV

THE RACIAL INFLUENCE OF INDUSTRIAL DEVELOPMENT.

"A few good and healthy men, rather than a multitude of diseased rogues; and a little real milk and wine rather than much chalk and petroleum; but the gist of the whole business is, that the men, and their property, must both be produced together—not one to the loss of the other. Property must not be created in lands desolate by exile of their people,—nor multiplied and depraved humanity, in lands barren of bread."—Ruskin, *The Queen of the Air*.

It is obvious that many of the most potent of the factors which influence the inherited qualities of man are the result of the great industrial development which has taken place during the past century. To give an adequate account of the complex and indirect ways in which the growth of modern industry has affected the development of the race is at present an impossible task. Even most of the simpler problems cannot be solved with the data at present available, and where the immediate result of certain forces seems fairly obvious there are commonly secondary and more indirect effects to be considered which stand in various relations with, and sometimes in direct antagonism to, the primary ones.

The magnitude and rapidity of the changes which industrial development has effected in the institutions of mankind tend to divert attention from the more obscure biological problems with which they are associated. It will perhaps be useful to formulate some of these problems, although we may not be able to contribute much to their solution.

Among the more immediate effects of industrial development are (1) the increase of population in many countries which has been rendered possible by the creation of additional occupations and the expansion of trade; (2) the growth and multiplication of

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industries which greatly affect the differential death rate of relatively large numbers of the population; (3) the growth of cities with the resulting subjection of their inhabitants to a changed and often deleterious environment and mode of life; (4) the effect of economic factors on the marriage and birth rates of different stocks; and (5) the possible influence of altered environmental factors on the trend of germinal variability.

We shall consider briefly these different topics, although it should be borne in mind that they are closely interrelated. The striking increase of the populations of civilized countries during the 19th century is in large part due to the application of science to industry which has increased enormously the wealth with which nature has been compelled to reward the labors of man. To a large extent also this increase of population has resulted from the reduction of the death rate which has followed the advances made in medicine, surgery, and especially those branches of hygiene which are concerned with the control of infections and epidemics. But whatever progress is made in the art of saving life, the population of a country must obviously be limited by the resources furnished by nature for human subsistence. The yield of nature has been greatly increased by the application of scientific discovery. Improvements in mining, manufacturing, agriculture and transportation make it possible for the earth to support a greatly increased number of inhabitants, and human population even now comes sufficiently near obeying the law of Malthus to respond to the opportunities thus created for its maintenance.

Through the increase of numbers which industrial development has made possible those races and peoples among whom such development has reached a higher stage are enabled, by war or otherwise, to prevail over races and peoples on a lower industrial level. The Anglo-Saxon has doubtless been aided in extending his domain on account of the very rapid growth of the population of Great Britain which followed upon the unprecedented development of her industries. The great economic development of Germany, by creating opportunities for her people at home and

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thereby checking her losses to other lands through emigration, has constituted a great element of strength to the empire, that might have resulted in an accelerated expansion of her dominion and a further increase of her population had the outcome of the war been more in accordance with her plans. Such effects of industrial development are the first results which follow upon the natural response of life to an increased means of support. But while increased production of wealth allows more individuals to gain a subsistence and may lead to national expansion, it sets into operation several influences which may deteriorate the quality of the expanding people. At the same time other tendencies are brought into play whose effect on the people is in the direction of racial improvement.

One complex set of factors may be grouped under the general heading of occupational selection, or the differential death rate among the employees of various industries. It is well known that the average expectation of life varies greatly among those engaged in different occupations. A considerable mass of data on this subject has been compiled in the census reports of several countries and by life insurance companies. The racial effects of occupational selection depend upon what relations exist between innate qualities and the choice of means of livelihood. Were those who follow different trades and professions recruited indifferently from all types it would be of no racial significance how rates of mortality are distributed. But people not only select occupations, but occupations select people. Different occupations demand various degrees of intelligence, reliability and diligence, to say nothing of different physical qualities, such as strength, endurance and quickness. There is no likelihood that a born dullard will become a captain of industry and a weakling by nature is not apt to qualify as a stevedore or structural iron worker. To a considerable extent the choice of an occupation is a fortuitous matter, depending upon tradition, education and the kinds of industry represented in a given time and place. Occupations are frequently changed, especially those requiring little skill and training. But notwithstanding a large element of purely

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fortuitous circumstance, there is doubtless a certain correlation between the kind of employment followed and inborn quality. As a result of the nature and diversity of industry, human beings are forced into lines of activity which very materially shorten life or cause a high percentage of accidental deaths. The differential death rate associated with various occupations is therefore a matter affecting the character of our racial inheritance.

The racial effects of occupational mortality vary greatly from industry to industry. In many cases the result is doubtless dysgenic. Dangerous trades which draw workmen of skill and capacity are racially bad. The high mortality among locomotive firemen, iron workers, glass blowers, workers in porcelain, lead and copper represents a loss of an inheritance of at least good average quality. Occupations which draw and exterminate the more incompetent types may on the other hand be regarded as a racial benefit.

Statistics on the average expectation of life of the followers of different trades and professions cannot always be accepted as an index of the relative healthfulness of the occupation in question. Those pursuits which are entered upon relatively late in life, such as the learned professions, tend to show an increased expectation of life because cases of death before the professional career is begun are not included. The average duration of life among casual laborers is decreased by the occurrence of many deaths in the ages below 20 years, but this would not be the case among clergymen or physicians. An index of occupational mortality which is better than the average age of death is afforded by the mortality at various ages of life.

The actual death rate among the followers of any occupation is a result of two sets of factors: (1) Those concerned with the occupation itself, and (2) those depending upon the kind of human material the occupation selects. Of the first, the wholesomeness of the occupation itself is of prime importance. Many trades cause a slow poisoning of those engaged in them. The disastrous results that follow work in lead industries have already been commented on. Phosphorus poisoning is not uncommon

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Mean Annual Death Rates per 1,000 Males of Different Occupations in England and Wales, 1900–02

Occupations	Age Groups		
	25–35	35–45	45–65
Clergymen	2.72	4.09	15.53
Physicians	5.58	10.56	23.87
Schoolmasters	3.64	5.54	15.76
Farm laborers	4.34	6.36	
Innkeepers	13.87	22.50	35.90
Coal miners	5.08	7.97	23.22
Tin miners	13.34	27.14	51.64
Carpenters	4.76	8.30	20.03
File makers	9.79	18.96	40.04
Farmers	4.07	5.90	14.82
Potters	5.49	14.95	39.12
Fishermen	8.44	12.44	18.63
Barristers	4.88	7.59	18.29
General shopkeepers	11.08	20.71	30.17

among the makers of matches, and many other industries take a high toll of their operatives as is shown by Oliver in his *Diseases of Occupation* and in his *Dangerous Trades*.

Other bad effects are due not so much to the occupation itself as to other circumstances associated with it, such as poor ventilation, dust, liability to contagion, and incitement to intemperance as is evinced by the high mortality of innkeepers and tavern keepers in England. Undoubtedly one of the chief factors in mortality is remuneration. Upon this depends the character of the lodging occupied, the quality of food, proper medical attendance during illness and many other advantages of a more indirect kind. Other things equal, in industry, the poorer the pay the higher the death rate, although it is of course only a part of the truth to say that the high death rate is because of the poor pay.

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Excluding a few dangerous or particularly unsanitary employments it is probable that the most potent factor in occupational selection is furnished by the quality of human material employed. The character of the men and women engaged is dependent upon their heredity and previous history. Undoubtedly, through no fault of their own, multitudes of human beings of good inheritance but born in unfavorable surroundings, deprived of educational advantages, and stultified by early hard labor are forced into the ranks of the unskilled and poorly paid laboring class. The relatively high death rate of such individuals is racially disadvantageous. But undoubtedly the ranks of casual and unskilled laborers are recruited much more than those of skilled trades and professions from individuals who have not been blessed with inherited gifts. If we consider for a moment the almost inevitable industrial fate of the rank and file of those who are mentally below par it will become evident that conditions could scarcely be otherwise. The subnormal individual usually fails to acquire anything more than the mere rudiments of education. He is generally lacking in initiative and enterprise; and since weakness of character is the usual concomitant of defective intellect, he is not apt to exhibit those qualities of persistence, reliability, and application which contribute so greatly to the industrial value of an employee.

One effect of industrial development which cannot fail to affect in one way or another the inherited qualities of mankind is the unprecedented growth of cities which has occurred during the last hundred years in the most advanced nations of the earth. The following table presents a bald outline of the percentage of population of several countries living in cities of 10,000 or more inhabitants at three periods, 1800,1850 and 1890.

In all these countries the growth of cities has been relatively fast as compared with the increase of the rural population. In England and Wales where there was a large urban population in the beginning of the 19th century the relative increase in the size of cities is about as rapid as in most other countries. In fact, the English census of 1891 reports an actual decrease of population in

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Percentage of Urban Population of Different Countries

	1800	*1850*	*1890*
England and Wales	21.30	39.45	61.73
Belgium	13.5	20.8	34.8
Prussia	7.25	10.63	30.
U. S.	3.8	12.	27.6
France	9.5	14.4	25.9
Russia	3.7	5.3	9.3 (1885)

271 out of 632 districts in England and Wales since the previous enumeration; in 202 of these there had been a decrease also in the decade from 1871–81. In Ireland the urban population has increased while the population of the country as a whole has diminished, the urban population in the last half of the 19th century nearly doubling its ratio to the rural. In France whose population has increased but little (2–3 million since 1840) the cities have rapidly grown, while the rural population has decreased by over 2½ million.

The United States has had an exceptionally rapid increase in urban population, as the following table indicates:

Growth of Cities in the United States

Date	*Percentage of Population in Cities of 8,000 Inhabitants or Over*
1790	3.35
1800	3.97
1810	4.93
1820	4.93
1830	6.72
1840	8.52
1850	12.49
1860	16.13
1870	20.93
1880	22.57
1890	29.20
1900	32.90
1910	38.80

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Considering the percentage of people living in towns of 2,500 or more inhabitants, the urban population in the United States in 1910 was 46.3 per cent and it is not improbably over 50 per cent at the present time. In several states over one-half the population lived in cities of 8,000 or more in 1910. It is evident that this country, despite its large size and the great extent of its agricultural industries, is fast following in the wake of the older nations of Europe in the urbanization of its population. In some parts, especially in New England, where the land has become partly exhausted or is relatively arid, the rural population in recent years has shown an actual falling off.

The growth of cities is due to the following causes: (1) natural increase of their population, (2) migration, and (3) the incorporation of outlying suburbs. These three factors vary enormously in different times and places. Gillette has attempted to estimate the relative share which each of these factors has played in the recent growth of cities in the United States. He separates the migrants into those from rural districts and those from foreign countries and presents the following table indicating the proportion derived from these different sources:

Sources of Urban Growth in the United States

Factor	*Number*	*Per Cent*
Incorporation	924,000	7.8
Immigration	4,849,000	41.
Natural Increase	2,426,000	20.5
Rural Migration	3,637,000	30.7
Total	11,826,000	100.0

These figures cannot be more than a rough approximation to the truth owing to the lack of precise and extensive data on the movements of the population. It may be noted that natural increase is responsible for only a relatively small part of the urban growth in this country, and it is equally noteworthy that a

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relatively large proportion of our city population is composed of people of foreign birth. The great tide of immigration that comes to our shores tends to lodge chiefly in our cities and large numbers never get beyond the original port of entry. New York which receives by far the largest number of arriving aliens had in 1910 a foreign born population of 1,927,703 or 40.4 per cent of her total inhabitants. The proportion of foreign born and their immediate descendants in our cities has increased rapidly in successive decades. In the Abstract of the Thirteenth Census of the United States it is stated that "Of the aggregate urban population—this is, the population of incorporated places of 2.500 inhabitants or more, including New England towns of that size—of the United States in 1910, 41.9 per cent were native whites of native parentage, 29 per cent native whites of foreign or mixed parentage, 22.6 per cent foreign-born whites and 6.3 per cent negroes. In the rural population, on the other hand, 64.1 per cent were native whites of native parentage, only 13.3 per cent were native whites of foreign or mixed parentage, and 7.5 per cent were of foreign born whites, while negroes constituted 14.5 per cent. Thus the foreign born whites and their children constituted fully one-half (51.6 per cent) of the urban population and only about one-fifth of the rural" (p. 91, 1916).

It is in New England and the Middle Atlantic States and some states of the north such as Illinois, Minnesota, Ohio, Michigan and Wisconsin that the foreign born constitute an especially large part of our city population; the south in general has been less affected by foreign immigration. The native born population of native white parents is in many cities decidedly in the minority. Thus this element in New York constituted in 1910 only 19.3 per cent, in Chicago, 20.4 per cent, in Boston 23.5 per cent, in Philadelphia, 37.7 per cent, in Milwaukee, 21.1 per cent, and in San Francisco, 27.7 per cent. Our larger cities especially of the east and north are becoming populated by foreigners and their immediate descendants. In view of the fact that this condition obtained to a considerable extent for several decades and that a considerable proportion of those counted as native Ameri-

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cans of native stock are in fact the descendants of foreign immigrants two or three generations back, it is evident that the proportion of old American stock in most of large cities is very small.

It is a matter of interest to ascertain something of the racial origin of those who are replacing the native American in our cities. Natives of different countries vary greatly in their tendency to choose an urban in preference to a rural habitat. The way in which the people of different nations distribute themselves may be seen in the following table taken from the Census report for 1910:

Proportions of City Dwellers Among Natives of Different Countries

	Number		*Per Cent*	
	Urban	*Rural*	*Urban*	*Rural*
Total population	42,623,383	49,348,883	46.3	53.7
Total foreign born	9,745,697	3,770,189	72.1	27.9
European	8,571,364	3,220,477	72.7	27.3
Great Britain	880,613	340,670	72.1	27.9
Ireland	1,144,997	207,254	84.7	15.3
Germany	1,669,315	832,018	66.7	33.3
Scandinavia	661,182	589,551	52.9	47.1
France	82,078	35,340	69.9	30.1
Russia and Finland	1,458,775	273,687	84.2	15.8
Italy	1,049,390	293,735	78.1	21.9
Austria and Hungary	1,233,804	436,778	73.9	26.1
Balkans	169,469	51,477	76.7	23.3
Asia	130,714	60,770	68.3	3.17

It is evident from the above table that the natives of Russia and southern Europe flock into our cities in greatest relative numbers, while the northern European stocks with the notable exception of the Irish and to a less extent the natives of Great Britain tend to settle more frequently in the country. According

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to the Census Report for 1910, "The only countries whose natives show a lower proportion residing in urban communities in 1910 than is shown for the white population of the U. S. (44.2 per cent) are Norway, Montenegro, and Mexico, and of these Mexico is the only one for which the percentage (34.2) was lower than that for the native whites of native parents (36.1 per cent)."

The general city-ward migration of the population has had a marked influence on the negro population of the nation, a fact of no small consequence for the biological fortunes of that race. In the decades ending in 1890, 1900 and 1910 the percentage of negroes living in cities of 2,500 or over was 19.8, 22.7 and 27.4, respectively. In the Southern States the negro population, like the white, is largely rural (over 75 per cent), but it is becoming gradually urbanized like the white race and at about the same rate. In the north, however, the negro becomes decidedly urban. In the New England States in 1910, 91.8 per cent of the negroes lived in cities; in the Middle Atlantic States the urban percentage was 81.2 per cent, in the Atlantic East North Central States 76.7 per cent, in the West North Central 97.7 per cent. New York with its 91,709 negroes and Washington with its 94,446 are the two largest negro cities in the U. S. Next in order come New Orleans (89,262), Philadelphia (84,459), Baltimore (84,749), Memphis (52,441), Atlanta (51,902), Richmond (46,733), Chicago (44,103), St. Louis (43,690), Nashville (36,523).

In the cities of the north, as a rule, the negro population has increased at a greater rate relatively to the number of negroes 30 years ago, than in the south, due largely to the fact that before and during the war the negro population was largely confined to the south. It is noteworthy, however, that in some of the colder cities such as St. Paul, Minneapolis and Milwaukee the negro population remains very small, less than 2 per cent.

How do cities affect those who dwell in them? The general effect of city life in the past, and to a considerable extent up to the present, has proven to be deleterious to a large part of their inhabitants. As destroyers of humanity they have ranked among the most potent. "Anthropologically," says Nordau, "the large

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town is ruinous. The large town is a far shining light house whose lamp consumes a mighty deal of fuel." In cities humanity is exposed to unnatural conditions of life. Frequently inhabitants are crowded together, with an inadequate supply of fresh air, exposed to increased risks of contagion and inducted into habits of vice that deteriorate their posterity as well as themselves. The effect of these untoward agencies is reflected in the rate of mortality which is generally higher in urban than in rural communities. We cannot, however, in all cases accept the mortality rate of cities as a reliable index of their healthfulness. As a measure of the actual influence of the city upon the duration of life it may be too high or too low. The presence of hospitals and asylums, orphanages and homes for the aged occasion a rise in the general death rate. On the other hand, barracks and institutions of learning, which contain many people at an age when the death rate is low, tend to produce an unduly favorable impression of the general salubrity of the city in which they occur. The same influence is exerted by the various industries which create a demand for the employment of men and women in the prime of life. On the whole, the death rate in cities tends to be abnormally low, because there are, as a rule, relatively more people of adolescent or middle age than in the country. The presence of many children of an early age naturally raises the general death rate, and where the birth rate has declined, as it has done to so great an extent in many cities, the general death rate becomes correspondingly reduced. A city may for various reasons have a very low death rate and nevertheless be a very unwholesome place in which to live.

Notwithstanding the causes which tend to reduce the rates of urban mortality as they are commonly expressed, the death rates of cities generally have been, and in some countries still are, greater than that of adjacent rural communities. This is shown for the United States in the following table giving the death rates of urban and rural communities in the registration area:

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Death Rates of Urban and Rural Communities in the United States

Date	*1900*	*1905*	*1906*	*1907*	*1908*	*1909*	*1910*	*1911*
Rural	15.2	14.4	13.7	14.0	13.3	13.0	13.4	12.7
Urban	18.9	17.1	17.4	17.5	15.9	15.4	15.9	15.1

Date	*1912*	*1913*	*1914*	*1915*	*1916*	*1901–05*	*1906–10*
Rural	12.5	12.7	12.3	12.3	12.9	14.1	13.4
Urban	14.7	15.0	14.5	14.2	15.0	17.4	16.3

As a rule the larger the city the higher has been the death rate. In the United States, according to the 11th census, the death rates of cities of different sizes were as follows:

Death Rates According to Size of Cities

Size of City	*Death Rate per 1,000*	*Population per Acre*
10,000–15,000	17.86	2.43
15,000–25,000	19.45	2.79
25,000–50,000	21.81	4.67
50,000–100,000	22.43	9.04
Over 100,000	23.28	15.15

Similar relations are shown in the towns of New England.

Death rate of New England Towns

District	*Ratios to the New England rate taken as 100*
Rural	94
Cities of 10–25,000	95
" " 25–50,000	105
" " 20–100,000	110
" " 100,000	116

The relatively rapid fall of urban death rates as compared with the rural is illustrated by the following table:

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Death Rates of the City and State of New York

Date	*Deaths in City*	*Rate*	*Rate per Rest of State*
1898–1900.....	67,516	20.15	15.25
1901–1909.....	71,684	18.6	15.3
1906–1910.....	75,868	16.8	15.8
1911–1915.....	74,668	14.4	15.6
1914.....	74,803	14.0	15.4
1915.....	76,193	13.9	15.2
1916.....	77,800	13.9	15.7

Part of this decline in New York City, says the Report of the New York Department of Health for 1919, "should be attributed to the migration from other communities and immigration from foreign countries, of large numbers of young adults who increased the population, but being in the healthiest age of life, contributed a smaller number of deaths than their proportion to the total population. When corrections are made for age composition, however, the advantage turns in favor of the country."

Crude and Standardized Death Rates in New York State and City

	Crude Death Rate for 1911	*Standardized Rate*
State of N. Y.....	15.6	15.8
City of N. Y.....	15.3	17.3
Rest of State.....	16	14.1

And in 1915, according to the report quoted, "the essentially greater healthfulness of the smaller communities and the rural districts of the state compared with the metropolis—hitherto obscured by the difference in the age make-up of their population —stands out in a standardized rate of mortality for 1915 for the state outside of New York City of 13.4 still two points, or 13 per cent below that of the metropolis."

In Europe urban growth and migration have been studied more

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extensively and intensively than in the United States, and a vast literature has been accumulated on these subjects. Up to the last quarter century the urban death rates generally exceeded the rural, but more recently, however, the death rate in cities has decreased more rapidly than in the country, so that in several countries the urban rate has become the lower of the two.

This fact may be illustrated by the following table showing the decline of the death rate in some of the principal cities and countries of Europe:

Decline of Urban and Rural Death Rates in Europe

	1881–85	1886–90	1891–95	1896–00	1901–05	1906–09	1910
London	20.9	19.7	18.8	18.5	16.1	14.4	13.7
England and Wales	19.4	18.9	18.7	17.7	16.0	14.7	13.5
Paris	24.4	23.0	21.2	19.2	18.0	17.7	16.7
France	22.2	22.0	22.3	20.7	19.6	19.2	17.9
Vienna	28.2	25.1	24.1	21.1	19.1	17.3	16.6
Budapest	31.5	30.8	25.5	21.6	19.8	19.4	18.4
Prague	32.7	29.6	27.1	24.4	22.6	19.6	15.5
Hungary	33.1	32.1	31.8	27.9	26.2	25.0	
Berlin	26.5	22.4	20.5	18.1	17.0	15.4	14.7
Munich	30.4	28.3	25.8	23.9	21.0	17.9	15.1
Breslau	31.3	28.8	27.4	25.0	23.7	21.1	19.9
Germany	25.3	24.4	23.3	21.2	19.9	17.5	16.2

In the German Empire the death rates for cities of over 15,000 or more inhabitants have averaged lower than for the rural districts since the seventies, although in Prussia the cities did not take the lead until the nineties.

Death Rates of City and Country in Germany

	1877–81	1882–86	1887–91	1892–96	1897–01
In cities over 15,000	25.73	25.83	23.46	21.71	20.46
In empire	27.5	27.3	25.2	24.0	22.4

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In Italy the death rates of the four largest cities fall below that of the Kingdom. The death rates of Rotterdam, Amsterdam and The Hague average lower than that of Holland, and those of Petrograd and Moscow lower than that of Russia in general.

The favorable showing made by European cities in comparison with the country is, however, deceptive. While the reduction of the death rate in cities, is mainly due to improved hygiene and sanitation and while cities often afford advantages in the form of superior education and better medical aid that tend to reduce the death rate more than in the country, their relatively lower death rate is largely the result of their different age composition. Taking the large cities of Germany as an example, the age composition as compared with the rest of the empire was in 1900, according to Ballod, as follows:

Age Composition of Cities and Country in Germany

No. per 1,000 Inhabitants	*Under 16 yrs.*	*16–30*	*30–50*	*50–70*	*over 70 yrs.*
In large cities.....	305	301	264	111	19
In rest of Empire.....	380	234	226	131	29

The relatively small number of children and old people in cities, and the large proportion of people in the most healthful period of life naturally tend to lower the death rate relatively more than in the country. That the favorable showing of cities is largely due to their age composition is shown by the fact that when we consider the average mortality of the corresponding ages of life in urban and rural communities the urban mortality generally exceeds the rural. This will be clear in the case of Germany by comparing the following table with the previous ones.

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Deaths per 10,000 in Germany (Mombert)

	1896	*1898*	*1900–01*
In Large Cities			
Died in 1st yr.	2,727	2,220	2,322
Died in 1 to 15 yrs.	1,153	1,048	1,073
Died in 15 to 60 yrs.	931	882	899
Died in 60+yrs.	6,596	6,663	6,861
Outside Large Cities			
Died in 1st yr.	2,450	2,053	2,134
Died in 1 to 15 yrs.	998	932	930
Died in 15 to 60 yrs.	892	850	879
Died in 60+yrs.	6,885	6,797	7,207

The statistics of Ballod show that for males of all ages and for females with a few exceptions in advanced age groups, the average duration of life in Prussia was greater in the country than in the cities.

Average Duration of Life in Prussia

Age	*Males*		*Females*	
	City	*Country*	*City*	*Country*
0.	38.71	42.75	43.65	45.20
5.	51.14	54.74	55.45	55.53
10.	47.61	51.24	52.09	52.09
20.	39.12	42.97	43.69	43.85
25.	35.24	39.71	39.71	39.88
30.	31.34	35.14	35.86	36.04
40.	24.14	27.24	28.37	28.52
50.	17.86	19.94	20.94	20.83
60.	12.32	13.40	14.09	13.71
70.	7.89	8.08	8.52	8.19

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The life tables for 1880–81, 1885–6 and 1895–6 showed for most age periods, except those of old age, that the death rate in general decreased with the size of the city and was markedly less in the rural districts. (Ballod.) In Berlin in the years 1890, 1895 and 1890, although the crude death rate was lower than it was in Prussia, there was a shorter average duration of life.

In certain regions the rural districts may be actually more unwholesome than the city. During the last few decades many cities have made remarkable records in the improvement of their sanitary conditions. And infant mortality which until recently continued in most cities to be inexcusably high has been rapidly reduced in the last decade. It is not surprising that many rural districts which have been relatively backward in adopting measures for improving the health of their inhabitants should have a death rate higher than that of near-by cities. The health record of cities has improved more rapidly than that of the country because there was more room for improvement; and we may look forward to much greater advances in the near future. But despite the great progress which has actually been made, and the existence of statistics which so often place the health of the urban population in too favorable a light, there is little doubt that cities have been and still are deleterious to the physical welfare of their inhabitants.

Besides their enhanced death rate, the unwholesomeness of cities is indicated by a number of other symptoms. As has been pointed out in a previous chapter, their birth rate is generally below that of the surrounding country, and where the crude urban birth rate exceeds the rural, it is usually owing to the presence of a relatively large proportion of women of child-bearing age in the city population. The average number of children per married woman of 15–45 years of age is, in most places, lower in the cities than in the country. Suicides are notoriously more prevalent in cities, their frequency diminishing with the size of the city. Cities usually show also a relatively high percentage of crime. Prostitution is prevailingly an urban vice, and associated with this is, as has been discussed in Chapter VII, a relatively high percentage

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of venereal disease, a percentage which becomes relatively greater with the increased size of the city and which cannot fail to have a marked effect on individual and racial vitality.

Cities generally exceed the neighboring country in the percentage of illegitimacy, the proportion of stillbirths, the relative number of married women who are sterile, the proportion of mothers unable to nurse their children, and in the prevalence of alcoholism and addiction to drugs. All these facts are indicative of the deteriorating effects to which city populations are subject and which cannot fail to affect either the average longevity of the stock or its power of perpetuation.

Further indications of the effects of the city are afforded by the extensive statistics on the fitness of recruits for military service. Where compulsory military service is in vogue and where all classes are subjected to examination, the data yielded is of much value. The percentage of recruits meeting the requirements for military service in Germany for 1907 and 1908 is given in the following table which shows the proportions accepted from cities of different sizes and from the country:

Percentage of Recruits Qualifying for Military Service in Germany

Size of City	*1907*	*1908*
Cities over 1,000,000	31.4	28.2
" 500,000–1,000,000	39.9	44.0
" 200,000–500,000	50.1	49.8
" 100,000–200,000	47.9	48.2
" 50,000–100,000	51.8	51.5
Country	58.0	57.7

According to Bindewald the superiority of rural recruits is not dependent upon occupation since it obtains within the limits of each trade or profession. He cites the following statistics of the percentage of those meeting the military requirements:

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Fitness of City and Country Recruits

	City Recruits		*Country Recruits*	
	Acceptable	*Unacceptable*	*Acceptable*	*Unacceptable*
Teachers	49.4	50.6	59.7	40.3
Shoemakers and allied trades	46.6	59.4	50.2	49.8
Smith and metal workers	66.4	33.6	71.1	28.9
Laborers	60.9	39.1	66.2	33.8

The most recent investigations of Burgdörfer have yielded results equally unfavorable to the city recruits.[1]

Many of the causes of reduced urban vitality are obvious, such as relatively poor air, especially in the congested areas. The water supply, formerly so frequent a cause of epidemics, has been improved in so many large cities that it is very commonly superior to that of the country. The milk supply, notwithstanding much improvement in recent years, is still sufficiently bad to be a potent factor in urban infant mortality. The greater readiness with which epidemics are carried in crowded areas is doubtless one of the chief causes of high urban mortality. Without dwelling upon statistics of the urban and rural death rates from different diseases, it may be stated that, on the average, the death rate from tuberculosis, measles, diphtheria, whooping cough, scarlet fever, enteritis, and especially pneumonia is much more heavy in cities than in the country.

Cities have proven to be consumers of men; they are vortices into which are drawn ever larger proportions of our race. It becomes therefore a matter of the greatest importance to ascertain upon what hereditary classes cities exercise their most destructive effect. The question involves a consideration of two problems, (1) the effect of urban life on the death rate and birth rate of different hereditary stocks, and (2) the hereditary characteristics of migrants to the cities as compared with those of the population in general. Granting that cities are potent consumers of humanity, do they destroy the superior hereditary types more

[1] Ann. deutschen Reichs, 1909, 888–909; 1910, 873–878.

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rapidly than the inferior ones, and do they attract the better or the poorer stocks from the surrounding country?

Probably the treatment of these questions which has succeeded in arousing the most discussion in Hansen's work *Die drei Bevölkerungsstufen*. Hansen divides the population into three classes: (1) the landowners from nobles owning estates to the peasants with small holdings, (2) the middle class consisting of officials, professionals, artisans, merchants, and (3) the proletariat and day laborers and people in general with scanty means of subsistence. Needless to say these are not well-defined groups and that there is a continual transfer from one group to another. The first class, the country dwellers, according to Hansen, constitute a large proportion of the rural contribution to the city population. It is this class that has the highest birth rate. Their surplus as a result of economic pressure flows to the cities where it supplies the second class with most of its members. Here they are subjected to conditions of life which enhance the death rate and reduce the birth rate so that, notwithstanding the superior economic status which they acquire, they rapidly diminish in number. Urban immigrants, according to Hansen, are of better average quality than those who remain to carry on agricultural pursuits. It is this rural influx that keeps up the vitality of urban populations, and is mainly responsible for urban growth. Many cities, were they dependent upon natural increase alone, would suffer an actual loss of population. Dr. Boeckh has estimated that the fertility of the city born in Berlin is not high enough to perpetuate the stock. Paris for a long time has not been self-sustaining. Lagneau calculated that were it not for immigration its population would decrease 50 per cent in each generation. Where cities grow through their own birth rate their increase is dependent upon the fertility of the proletariat, since the middle class is generally not self-perpetuating. Between the recruits coming from other classes and its own fecundity the third stratum perpetuates itself even under the unfavorable conditions into which it is forced through economic pressure. But through overcrowding, poor food and other destructive agencies, it tends,

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according to Hansen, to degenerate. The children, poorly nourished and brought up with inadequate education, recruit the army of vagabonds and ne'er-do-wells that forms so heavy a burden upon the productive members of society. Thus cities, according to Hansen, are racially destructive. They cause a gradual deterioration of their inhabitants and constitute a potent factor in the decline and fall of empires.

Views similar to those of Hansen have been set forth by Ammon. This writer differs from Hansen in that he does not consider that the rural migrants become at once members of the middle class. The majority begin at the lower rounds of the ladder, becoming servants, janitors, waiters, teamsters, etc., and subsequently work up into the skilled trades and higher professions. During this period they are subjected to the rigid operation of natural selection. The less intelligent and forceful brachycephalic types are eliminated in a few generations. The dolichocephalics tend to succeed both in the struggle for wealth and position as well as in the more literal struggle for life. As a result, cities tend to become composed of a relatively high percentage of the dolichocephalic type. The anthropometric studies of Ammon upon the population of Baden have yielded results supporting this conclusion, inasmuch as he finds that the urban population is more dolichocephalic than the rural, and that the successful types are more dolichocephalic than those of inferior status. But in the long run, city life proves fatal even to the victors in the struggle. Ammon who shares the very prevalent German persuasion regarding the long headed, blond "Germanic" type, naturally looks upon the process of urban migration as destructive of the best elements of the race. The rural population it is which is the source of national vitality. "Der Bauernstand ist nicht ein Stand wie jeder beliedige andere, der sich durch Zugang neuer Kräfte ergänzt, sondern er ist eben der Vorratsbehälter, der Jungbrunnen der Menschheit, er hat die Nachschübe für alle anderen Stände zu liefern, in denen die Menschen nach dem natürlichen Laufe der Entwickelung sich verbrauchen und zerstören."

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There is no doubt that the opinions expressed by Hansen and Ammon have been widely influential in Germany and have stimulated interest in the agrarian policies carried out in that country. Militaristic writers,—and we must count Hansen and Ammon among them,—have viewed with much concern the relatively poor showing which cities have made according to recruiting statistics and the records of urban birth rates. In numerous German discussions of the subject that appeared before the Great War we find frequent allusion to the "Wehrkraft" or "Wehrfähigkeit," which it was feared might not retain its relative superiority in face of the portentous fecundity of the Slavic neighbors of the empire. The situation which has called forth so many lamentations from Germany obtains to almost as great an extent in most other civilized countries, although its military aspect has caused much less uneasiness. The questions raised by Hansen and his followers are of the most serious consequence to mankind in general, and it should constitute a part of the program of institutions dealing extensively with vital statistics to collect the data required for their solution.

The views of Hansen, Ammon and their followers have elicited a great deal of adverse criticism on a number of points. The fact urged by Kuczynsky that cities often have a fairly high birth rate and a death rate lower than that of the country is by no means a proof that cities are self-perpetuating. Weber cites as a fatal objection to Hansen's theory the circumstance that in Germany "in several years the ratio of births to deaths has been larger in the great cities than in the Empire as a whole, and in recent years the two ratios have been about the same." It is, however, only an apparent paradox to say that a surplus of births over deaths does not indicate that city populations are self-perpetuating. The immigration of people from 20–40 years of age reduces the death rate and tends to increase the birth rate. How much of the urban increase is due to the fecundity of immigrants from the country is not known. A very considerable part of the population of cities, and a larger proportion of the population of large cities, according to the principle announced by the statisti-

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cian Von Mayr, is of outside origin. But until more is known of the relative fertility of those born in the city and those who come in from the country it cannot be ascertained to what extent the populations of cities are really self-sustaining. As stated previously the population of Paris and that of Berlin is not reproducing itself. The remarkably low birth rate of several cities of Switzerland renders it probable that the same conclusion holds for them also. Ballod has attempted to show, on the basis of studies on the average duration of life in Germany, that in several large cities the population would show a small deficit were it not for the influx of people from the outside who help to swell their birth rate. The same conclusion is drawn for ten of the most urban districts of France. Estimates of the real natural increase of cities present many difficulties and in most cases data are not available for a separate estimate of the births of the native and the immigrant elements of the city population. Ballod's calculations were based on statistics compiled in the last two decades of the 19th century, since when there has been a considerable decline in urban birth rates. Death rates have also declined so that comparisons with present day conditions cannot be made without an extensive reinvestigation. We are reasonably safe in saying, however, that several cities would not sustain themselves at the present time if it were not for immigration from the outside.

The rapid fall of the urban birth rate has affected most the classes upon whose intelligence, initiative and energy the rank of a people mainly depends. It is a very difficult task to estimate the eugenic worth of city immigrants as compared with that of the native city born; data on the subject as well as opinions are conflicting. With more accurate and extensive demographical bookkeeping this important question could doubtless be definitely settled. But however the stream of urban migration compares with the rest of the race, the process of diminishing the capable and enterprising elements of the community is apparently intensified in cities, and especially large cities.

One important consequence of the development of modern industry is the increasing employment of woman and the growing

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emancipation of women from economic dependence upon man. What are the racial effects of this movement is a question which has naturally attracted much attention and elicited much discussion. A solution of the question involves a number of subsidiary enquiries as to the effect of the changing industrial status of women upon the marriage rate, death rate and fecundity of the different hereditary classes of their sex.

Among women, as among men, those engaged in skilled labor or in professions marry later than those in ordinary employment. In Prussia, according to Prinzing, the average age of marriage is low among factory workers (24.6–25.5) and cigar makers (23.5), a little higher among shop girls (25.8), seamstresses (26) and waitresses (24), and higher still among teachers (29). The English textile worker marries before the shop girl, and the latter before the trained employee. The higher the status the less frequent also are the marriages. The development of industry by creating opportunities for an independent career for women tends to induce the more capable to enter upon those pursuits in which we find a low marriage rate. The proportion of married women is usually greater in the country, where only a relatively small number of women are working for wages than it is in cities. The stream of cityward migration is frequently composed of more women than men.

The influence of the industrial mill upon the physique of the throngs of young women that seek an independent livelihood is only too frequently far from wholesome. The fatigue, poor housing conditions and nervous strain to which they are subject deprive many of the natural inclination to marry or render them less apt to be chosen as wives. But the baneful influence of industrial development is not so much its effect upon the physical welfare of womankind in general, as its tendency to divert the better endowed from the duties of motherhood.

Besides the effect of employment of women upon marriage we must reckon with its influence upon women after they are married. The proportion of married women who are employed in gainful occupations is of course much smaller than in the un-

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married, and it tends as a rule to be large where the wages of the husband are low. In many industrial towns and cities it is common for both husband and wife to be employed in the same industry. When the wife is employed outside the home, infant mortality is generally found to be higher than when she looks after her own household. The employment of married women thus has its effect upon the death rate and brings into play a form of selection whose racial effects may be good or ill as a number of attendant circumstances determine.

Besides the influence of industrial development upon the birth rate and death rate of different hereditary classes, there is the possibility of important effects upon the production of variations in the germ plasm. If germinal variations arise in response to changes in the environment it is highly probable that the profound influence which industrial development has exerted upon the conditions under which people live and work may have produced some modifications in the inherited qualities of the race. Economic conditions not only have their effect upon the prevalence of alcoholism, but they lead to an abnormal congestion of population under conditions unfavorable for healthy living and thereby increase the prevalence of many diseases which may possibly produce permanent changes in the germ plasm. Statistics on the causes of death in cities bring out clearly how different are the biological conditions to which the urban dweller is exposed as compared with those which surround his rural compatriot. As we have pointed out in a previous chapter, we are ignorant of how environmental changes affect the germ plasm of human beings. We can only say that since our industrial development has so greatly modified the environment of large masses of mankind it is not improbable that more or less change has thereby been produced in the germ plasm of the race.

The course of evolution in man has been influenced to no small degree by the migration of peoples, whether this has occurred as the result of conquest, or by the more orderly method of peaceful invasion. People ever tend to overflow their boundaries as a result of the pressure coming from their increase in numbers.

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While migration sometimes occurs for the sake of religious liberty, or in order to escape from a despotic political régime, the chief driving force is usually want of the necessities of life. It would require a volume to discuss adequately the rôle which migrations have played in the evolution of man, and no attempt will be made to point out more than a few aspects of the problem. When one people invades the territory of another, either type may supplant the other, or they may combine to form a hybrid stock. In modern times especially, the effects of migration are complicated with the problem of the influence of racial amalgamation. This is particularly the case in a country like the United States where the problems of immigration are more pressing than in almost any other place on the globe. It is to this country that our few remarks on immigration will be mainly confined.

The United States has long been the great "melting pot" of the nations. Formerly our immigration was mainly from the north of Europe, consisting of English, Scotch, Irish, Germans, Scandinavians, mostly members of the great "Nordic race." This source of supply has now failed to furnish more than a small proportion of our immigrants. For some decades our influx from abroad has consisted mainly of Russians and Southern Europeans,—Greeks, Italians, Portuguese, Southern Slavs, Turks, Bosnians, Rumanians and Armenians. On the West coast we have received a considerable number of Chinese, Japanese, Hindus, Filipinos and other peoples in lesser numbers. Some of the latter elements will assimilate slowly, if at all, with our native population, but those arriving on our eastern shores, although they tend to form segregated groups in our cities and elsewhere, will probably become amalgamated in the course of a few generations in the great melting pot.

Naturally the biological effect of this influx of foreigners depends largely on their hereditary qualities. While there is no doubt that many of our immigrants are of excellent stock, it has been seriously doubted if the great mass of Greeks, southern Italians, Portuguese, Syrians and Turks measure up to the general intellectual level of the peoples of Nordic stock which

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constituted the great bulk of our population of a couple of decades ago. There is little in the achievements of these people either here or in their native land to remove this doubt. It is of course easy to make excuses for the shortcomings of people of inferior educational status. One may argue, as indeed many do, that we cannot demonstrate that such people are not of as good mental inheritance as the best of the Nordic race. On the other hand no one has ever shown that they are.

There is the further question of how our immigrants compare with the general average of people of their native country. Those who wander forth to seek their fortune in another land are frequently spoken of as unusually hardy, physically vigorous, and enterprising. Under certain conditions this may be true. But it is extremely doubtful if our present immigrants are especially selected for their virile qualities. They represent for the most part the poorer classes of wage earners from the old world. In too many cases they are the failures that seek an escape into a new field of opportunity. Thousands are induced to come here by the lurid accounts of America's golden opportunities which have been presented to them by the agents of transportation companies who have combed Europe for possible passengers. Mine and factory owners caring nothing for the racial and social effects of their action, but solicitous only for the profits to be derived from a plentiful supply of cheap labor, have encouraged immigration to the utmost and have exercised their strong political influence to lower the standard of admission.

We forbid the entrance of the feeble-minded, epileptic, insane, paupers, criminals, prostitutes and anarchists, but we are far from detecting all of these undesirables, and we receive a large mass of sodden stupidity, which escapes falling into the lowest class of mental defectives. Undoubtedly we would gain much by a more rigid scrutiny of our immigrant population. It would be especially desirable if mental tests could be applied to all arriving aliens so as to exclude at least everybody below the level of a high-grade moron. It would also be desirable to have a mental rating of foreign peoples to the end of discouraging or preventing

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entirely the entrance of the inhabitants of certain countries. The needs of employers for cheap labor are of very minor consequence when compared with keeping the blood of the nation free from contamination by inferior breeds of humanity. Considerations of blood and not dollars should dictate the immigration policy of our country. In the long run the eugenic policy will prove the most valuable economically as well.

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CHAPTER XV

THE SELECTIVE FUNCTION OF RELIGION

"If we are right in believing that the religious instinct is the only force strong enough to influence mankind, consciously or unconsciously, to consider the race as distinct from the individual, it is clear that the character of the national religion, the correctness of the biological principles its teaching embodies, the devotion, fidelity and number of its adherents, will be the real criterion of success or failure." —W. C. D. and C. D. Whetham, *Heredity and Society*, p. 54.

THE part which religious beliefs and practices have played in the evolution of mankind is undoubtedly one of no small importance. Man is not only a political animal; he is also a religious animal. From the remotest periods of history human behavior has been subject to the guiding influence of belief in some kind of supernatural agency. These beliefs often afford a powerful aid to the maintenance of the solidarity of the group which is so important an aid in inter-tribal or inter-national struggles. In fact many Darwinians attribute the development of the religious impulses of man to their value in subordinating the egoistic tendencies of human beings to the interests of their social group.

One of the most prominent advocates of this view, Mr. Benjamin Kidd, remarks: "In the religious beliefs of mankind we have not simply a class of phenomena peculiar to the childhood of the race. We have therein the characteristic feature of our social evolution. These beliefs constitute, in short, the natural and inevitable complement of our reason; and so far from being threatened with eventual dissolution they are apparently destined to continue to grow with the growth and to develop with the development of society, while always preserving intact and unchangeable the one essential feature they all provide for conduct. And lastly, as we understand how an ultra-rational sanction for the sacrifice of the interests of the individual to those

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of the social organism has been a feature common to all religions we see, also, why the conception of sacrifice has occupied such a central place in nearly all beliefs, and why the tendency of religion has ever been to surround this principle with the most impressive and stupendous of sanctions." Religion viewed from this standpoint has a distinct biological value and hence natural selection would tend to favor the development of those impulses and emotions which make man a religious animal.

There is perhaps no better illustration of the aid which religion affords in the process of group selection than its effect upon the birth rate. And it is a significant fact that militarists of the Bernhardi type who bewail the loss of man power which results from the falling birth rate are very solicitious for the maintenance of religious beliefs on account of their influence in checking the artificial restriction of births. A religion that emphasizes the injunction to be fruitful and multiply may do much to counteract the limitation of the family which so often results from egoistic motives.

Undoubtedly the relatively high fecundity of the Catholics is due in part to the strong stand taken by the church against any artificial interference with the propagation of life and to the encouragement which she gives to her adherents to bring into the world a plentiful supply of human beings to recruit her ranks.

In general the birth rate of Catholic countries is higher than it is in countries which are mainly Protestant, although this is probably not due to religion alone. In France, although it is largely Catholic, the birth rate is low, but it is relatively higher in districts such as Finisterre (27.1) and Pas de Calais (26.6) in which the proportion of Catholics is large. The same situation obtains in Germany where, according to Borntraeger, the Catholic districts are more prolific than the Protestant, and the places where the free-thinking elements proponderate have the lowest birth rate of all. In Prussia the fecundity of marriages according to the religion of husband and wife is shown in the following table:

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Children per Marriage in Prussia, 1875–90, According to Religion of Contracting Parties

Creed of Fathers	*Creed of Mothers*		
	Evangelical	*Catholic*	*Jewish*
Evangelical	4.35	3.30	1.78
Catholic	3.34	5.24	1.66
Jewish	1.58	1.38	4.21

It may be seen from this table that the greatest number of children (5.24) are born from marriages in which both parties are Catholic. Marriages between people of different faiths is associated with a marked reduction of the size of the family.

The recent studies of von Schrenck have shown that the birth rate of the Protestants in Riga has fallen to 15–16 per 1,000. With a death rate of 19.5 per 1,000 the natural increase of the population has practically stopped, and were it not for the Catholics and the adherents of the Greek church, both of whom have a high birth rate, it would probably decrease in number. The women of Catholic Ireland rear a larger number of children than those of England and Scotland whose population is mainly Protestant. Webb states that from 1881–91, while the birth rate was falling in England, the Irish birth rate (measured in terms of the fertility of marriages) rose 3 per cent and in Dublin 9 per cent.

The English towns with the highest birth rate are those with the highest proportions of Catholics and Jews. Mr. Booth has pointed out that in Leeds which contains a large Catholic and Jewish population the birth rate is relatively high (23.2), while in Bradford, which is located near by and has much the same industries, the birth rate is much lower (19.3). The seven most prolific boroughs in London are just those having the highest proportions of Catholic and Jewish inhabitants. And among people so similarly situated as the landed gentry of England we find that while the number of children per family fell from 7.1

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in 1831–40 to 3.7 in 1871–90, the number of children per Catholic family in the latter decade continued large, viz., 6.6.

In Canada there are marked inequalities in the birth rates of different regions according to the prevailing religion of their inhabitants. Quebec which is almost entirely Roman Catholic has a notoriously high birth rate of 37.2. Nova Scotia which has a high proportion of Catholics has a birth rate of 25, while Ontario with a larger Protestant population has a birth rate of 22.6. Manitoba and British Columbia with birth rates of 15.9 and 14.9 respectively, are mainly Protestant, but there are several other circumstances which tend to lower the birth rate of these provinces so that the influence of religion may not be more than a minor factor.

Those states of our own country in which the Catholic population is large have a high birth rate. In Rhode Island according to Hoffmann "it is shown by the census [of 1905] that of 33,727 married Protestants of all nationalities, 24,514 or 72.7% were mothers, and of that number 9,213, or 27.3% were childless. Of 34,160 Roman Catholic married women of all nationalities, 27,438, or 80.3% were mothers and 6,722, or 19.7% were without children." And there is much evidence that a high Catholic birth rate prevails throughout the nation in general.

As has been pointed out previously, the birth rate of different components of our population varies greatly according to nativity. Our recent immigration which comes largely from southern Europe contains a high percentage of adherents to the Roman church. Owing to this immigration and the high fecundity of Catholic stocks the Catholic church in several states has come to number more members than all other denominations combined. The once Puritan state of Massachusetts contained in 1906, 1,100,000 Catholics and only 450,000 adherents of all Protestant sects. New York numbers 2,300,000 Catholics and Illinois over 1,000,000 while the largest Protestant denomination in each of these states contained 300,000 members.

The adherents of a religious body in any country may increase (1) through the immigration of foreign members, (2)

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through the acquisition of new converts, and (3) through the birth rate. In the United States the growth of the Catholic church is mainly through the first and third of these methods. It is evident that the Protestant constituents of our population are not increasing so rapidly as the Catholic, if indeed their own birth rate would provide any increase at all. Should present tendencies continue, and if the Catholic church resists the agencies which tend to undermine the faith of its adherents, the majority of our population will soon come under the sway of this great religious organization.

We shall not discuss the social and political consequences which would follow from such an event. Undoubtedly they would be great, and they would indirectly have a decided influence upon the course of our racial development. The immediate consequence to the race would be the replacement of the Nordic stocks, such as the English, Scotch, Scandanavians, Danish and northern German elements, by peoples from southern and middle Europe. Many of the latter stocks are of good native quality, but there are others from the more southern and southeastern parts of Europe whose relative inherent worth is at least open to suspicion. At any rate, the stocks which promise to gain ground in the United States are different in many features of natural temperament and disposition, if not in intellectual development, from the present average of our population. Their relatively high birth rate, while dependent to a considerable degree on other circumstances, such as education, economic status, traditions, etc., is undoubtedly influenced strongly by their religious beliefs. We must therefore reckon upon religion as one of the potent forces which are changing the racial composition of the inhabitants of this country.

It is scarcely necessary to point out that among people such as the Japanese in whom the duty of fecundity is impressed with all the force which religious sanction can bring to bear, religion becomes a powerful factor in racial expansion. Among the Japanese, religion has a peculiar potency because of its close association with patriotic feeling. Where religion lends its sup-

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port to the realization of national ambition for power and prestige, as it has so frequently done in the history of the world, it creates a stimulus to strife and a menace to the peaceful relations of mankind.

One of the ways in which religion may affect the inherited qualities of mankind is through the persecution of those who do not subscribe to prevailing beliefs. While religious persecution has been more or less in vogue for long ages, it is only occasionally that is has been practiced on a scale sufficiently extensive to make it an important influence on racial inheritance. Both Catholic and Protestant Christianity show an unenviable record for persecution which has scarcely been equalled in the known history of any pagan religion. The men of superior intellect and force of character who during the inquisition have fallen victims to the zeal of intolerant devotees of the current creed number many thousands. Llorent (*Hist. de l'inquisition*, tom. iv, pp. 371–372) states that the Spanish Inquisition alone burnt more than 31,000 persons and condemned 290,000 to other forms of punishment. According to Lecky (*Hist. of Rationalism in Europe*, vol. 2, pp. 40–41) "the numbers of those who were put to death in the Netherlands alone, in the reign of Charles V, has been estimated by a very high authority at 50,000 and at least half as many perished under his son." In the 17th century over three hundred thousand Protestants were said to have been put to death in various ways, and an equal number emigrated. The loss of large numbers of the Huguenot stock as a result of persecution has generally been adjudged a great damage to the French people, although other nations may have been benefited by receiving the refugees which escaped imprisonment or death. Without dwelling further on the gruesome history of persecutions during the Christian era, or upon the persecutions which have occurred from time to time under various non-Christian religions, it may be said that the racial effects of this pernicious practice have probably been on the whole dysgenic. Galton, in speaking of the persecutions in Spain, says that "It is impossible that any nation could stand a policy like this without paying a heavy penalty in the

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deterioration of its breed." Weak, timid and sequacious people are not apt to be singled out for championing an unpopular cause, or for defending what is considered a dangerous heresy. As Lapouge remarks, "the persecuted are the superiors of their persecutors"; they are apt to be the bold spirits who are willing to brave personal danger for what they deem to be the truth. And any country in which persecution has been vigorously carried on for a long period of years cannot fail to lose a large proportion of its best inheritance.

Another dysgenic effect of religious selection is occasioned by the celibacy of the clergy, which has grown up especially in the Catholic church. Whatever may be said of the eugenic worth of the women who take the veil, the men who become priests or monks are above the average level of intellect. De Candolle in his *Histoire des sciences et des savants* has cited a long list of eminent men who were sons of Protestant clergymen and who would not have been born had the institution of celibacy prevailed in the Protestant churches. Of the 101 scientists who were foreign members of the Academy of Sciences of Paris, 14, or over 13 per cent, were the sons of pastors. As Lapouge has pointed out, a large proportion of eminent Jews are the sons of rabbis. For a long time the church afforded one of the most promising careers for men of exceptional intellect and character. To the extent to which such men were committed to a celibate life, the race suffered a loss of a valuable inheritance. Since the population of the Catholic world has sustained this loss for many centuries the cumulative effect of such a dysgenic process could scarcely fail to be considerable.

An effect of religion more widespread than the one just discussed is the tendency of the adherents of a particular cult to marry only within the limits of their own fold. Thus arises what Mr. Gulick would designate a form of "segregate breeding" whose effect is analogous to that of geographical isolation. Any isolated group tends, through continuous inbreeding, to become more and more nearly homozygous in successive generations. For this reason and perhaps others also, groups of a given species

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tend, when isolated so that they do not interbreed or interbreed only at rare intervals, to diverge in character.

Membership in a religious organization acts as a barrier to check free intercrossing. Catholics usually marry Catholics, Jews generally marry Jews for reasons of religion as well as of race, and Protestants not only generally marry Protestants, but they commonly marry within their own particular sect. "In Prussia," according to Mayo-Smith, "during the period 1875–90, 94.77 per cent of the Protestant men, 88.20 per cent of the Catholic and 94.79 per cent of the Jewish, married women of the same religious confession."

Formerly the tendency to marry within the fold was much stronger than now. The Quakers expelled members who married into other denominations. And in denominations in which outside marriages were not forbidden, the general sentiment deterred most of the members from marrying persons of different religious views. The customs of limiting marriage to members of a group tends eventually to produce a uniform type with characteristics somewhat different from those of other inbred groups. A multiplicity of sects each discouraging marriage outside its own organization tends to break up a people into a multiplicity of types, each of which tends to become more and more uniform in character as time goes on. Where sects are small in numbers this may well produce noticable results in a few generations.

When we compare the present influence of religion with the influence which it is feasible for it to exert we cannot fail to become conscious of a painful discrepancy. Protestant Christianity has practically failed to affect the practice of its adherents in regard to one of the most fundamental of duties. And the Catholic church which has attained a measure of success in checking the restriction of births, gives indiscriminate encouragement to the fecundity of all classes whether their heredity is good or bad. The Right Rev. Monsignor W. F. Brown in setting forth the attitude of the Church before the National Birth Rate Commission declared that the State cannot lawfully forbid the marriage of the physically defective or even the feeble-minded. If

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the probable issue of the mating of feeble-minded persons be feeble-minded children the Church might advise abstention from procreation, but there would be no rightful authority, either within the Church or out of it, for preventing such couples from disregarding this gentle advice, as they would be practically certain to do.

There is a strong tendency on the part of clerical teachers to base their advice concerning marriage and the perpetuation of life upon scriptual texts or traditions handed down from the Church Fathers, without considering matters of heredity or racial welfare. A standpoint determined by an appeal to authority is apt to be little affected by the advancement of knowledge: it practically deprives knowledge of its most important function which is the better guidance of conduct. It is especially unfortunate that a religious organization which really has some influence upon the birth rate of its adherents should so generally fail to exert its power to promote the improvement of the inherited qualities of mankind. It is gratifying to find, however, that some of its more progressive leaders have here and there lifted up their voices against the perpetuation of inferior strains of humanity, although they are as yet like voices crying in the wilderness.

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CHAPTER XVI

RETROSPECT AND PROSPECT

"O, yet we trust that somehow good
Will be the final goal of ill,
To pangs of nature, sins of will,
Defects of doubt, and taints of blood."
Tennyson, *In Memoriam.*

"As an agency making for progress, conscious selection must replace the blind forces of natural selection; and men must utilize all the knowledge acquired by studying the process of evolution in the past in order to promote moral and physical progress in the future. The nation which first takes this great work thoroughly in hand will surely not only win in all matters of international competition, but will be given a place of honour in the history of the world."—Leonard Darwin, Presidential Address before the First International Eugenics Congress.

In the course of the discussions in the previous chapters there is one question which must have occurred to the reader on more than one occasion: What are the changes that are actually taking place in the inherited endowments of man? Can we prove by observation, statistics or otherwise that the race is either improveing or deteriorating?

There is conclusive evidence that in many countries the present population differs in certain physical features from the population of one or more generations ago. One chief reason for this is that the ethnic composition of peoples is subject to comparatively rapid fluctuations. In several rapidly growing countries such as England, Germany, Austria and the United States, emigration immigration and differential fecundity have produced many changes in the last few decades. In most cases, the characteristics in which modifications are demonstrable are physical traits such as stature, cephalic index, and color of hair and eyes, which stand in a very doubtful relation to progressive or retrogressive development.

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We sometimes find a diminishing stature alluded to as an index of physical degeneracy. In several localities the stature of the population has decreased. It is unusually low, for instance, in many English towns (Beddoe), and Ripley has stated that in Europe in general it is lower in the cities than in the country. In other localities, as in parts of the United States, the stature of population has increased. Undoubtedly heredity is a large factor in the changes of stature which have occurred in many places, but where we find stature diminishing we are by no means justified in attributing it to a hereditary degeneracy of the inhabitants.

Many physical characters of man are affected considerably by environmental agencies. The latter are especially prone to influence strength, longevity, rate of growth, the prevalence of various diseases, and to a less extent, stature and weight. Conditions of life, especially in large industrial centers, have changed in such a way as greatly to affect the physique of a large part of the inhabitants. The relatively low stature of city dwellers is probably due largely to this cause, but, as Ammon has pointed out, there may be in certain cases an urban migration of taller stock.

To a certain extent environment may account for the degenerate condition so frequently observed in the teeth of civilized races. Platschick found dental caries in 92 per cent of 12,018 individuals examined, and Röse discovered among 5,600 recruits for the German army only 5 per cent whose teeth were entirely sound. The cooked foods, and especially the sweets, which are consumed from childhood on doubtless contribute to this condition. Many observers have commented on the excellent teeth possessed by the primitive races and by men who lived in previous epochs. Professor D. J. Cunningham, for instance, in his testimony before the Committee on Physical Deterioration stated that "it is an obvious fact that the teeth of the people at the present time cannot stand comparison in point of durability with those of the earlier inhabitants of Britain." Professor Dolomore also stated before the same committee that "in ancient British skulls not only is the arrangement good, the jaws are well devel-

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oped, the teeth placed in a normal arch, but caries, if present, is of slight extent, indeed mere specks."

It is not improbable that, as Kingsley[1] has pointed out, many dental irregularities and maladjustments are the result of racial crossing. With more or less independent variability of jaws and teeth it often happens that the teeth are unduly crowded in small jaws or are otherwise out of normal relations. It is a common opinion among those who have written on the subject, that while food and other environmental conditions are potent causes of dental deterioration, the withdrawal of natural selection has been an important contributory cause also. This conclusion is not improbable, but it is not capable at present of statistical proof.

Along with the deterioration of teeth there seems to be a correlative tendency to the loss of hair. Baldness is much more common with us than among primitive races. Although this is commonly ascribed to wearing hats, recent studies of the inheritance of baldness have shown that this common infirmity depends largely on ancestry and that the influence of hats has been greatly exaggerated. Baldness has never been associated with general degeneracy. On the contrary it is a not unusual adjunct of distinguished personality. The loss of hair may be bewailed partly on account of a certain protective value which it continues to possess, and still more on æsthetic grounds, but further progress toward universal baldness would probably not prove a serious drawback. We have all but lost the use of some of our ear muscles and entirely lost the use of others, but we are no worse off in our present mode of life. Our little toe is said to be degenerating and there are probably several minor structures in the same situation. A further degeneration of the vermiform appendix would probably be a positive advantage.

It is a fairly general opinion which has a considerable following in medical circles that the physique of modern civilized woman has become rather seriously weakened in the last few generations. One index of this is the increasing difficulty experienced in bearing

[1] A Treatise on Oral Deformities, 1880.

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children. Dr. A. Bluhm states that in the Grand Duchy of Baden "since 1871 to 1879 artificial premature births have increased eight-fold, perforation three-fold, and embryotomy has doubled; moreover the number of Cæsarian sections, which are generally intended to avoid perforation and embryotomy, have increased nine-fold." This is not due, according to Dr. Bluhm, to an increased tendency to perform operations. "Artificial premature birth, on the one hand and perforation and embryotomy on the other are two species of operations, one precluding the other. If the number of premature births increases, the numbers of perforation and embryotomy should fall. If both rise this points of necessity to an increase in the inability to bear."

The ease with which the women of primitive races bear children has often been remarked upon. It is not improbable that the matter has usually been exaggerated.[1] The after effects of this facile child bearing have not often been followed up to determine how it affects the future health of the mother. Child-bearing is easier among women who are used to a moderate amount of physical labor. Undoubtedly the life of modern women, especially those of the more well-to-do classes, is not favorable to easy child bearing. The form of the pelvis is unfavorably influenced by a sedentary life. The employment of large numbers of young women in sedentary occupations such as stenography, office work, etc., cannot fail to multiply the troubles of childbirth. It is difficult to estimate, however, the extent to which environment is responsible for the present difficulties of parturition. The form of the pelvis is a transmissible characteristic. The frequency of narrow pelvis has been found by Röse to vary considerably in different parts of Germany; those regions in which this defect is common are found to have the largest number of children who were artificially fed. This investigator also found that breast-fed children were superior in later life to those artificially fed, in weight, character of teeth, intelligence and general physical development.

If difficulty of bearing children depends upon a hereditary

[1] See Ploss-Bartels, *Das Weib*, 8th ed. 1905.

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conformation of the pelvis which is correlated, in a measure, with other physical defects, the influence of obstetrical skill will probably result in saving from elimination the progeny of large numbers of imperfectly developed women and thereby storing up more troubles for the future. As Dr. Schallmayer has remarked, "The more successfully obstetrics develops, the more necessary will it become for future generations."

Another much discussed physical defect of modern woman is her frequent inability to nurse children. Dr. A. Bluhm who has made an exhaustive investigation of the subject estimates that in Germany only about two-thirds of the women are able to supply their infants with sufficient milk for their needs. Those who have lived among primitive peoples have frequently commented on the almost universal ability of mothers to feed their children at the breast. Dr. Ogata, according to Hegar, states that in Japan women nurse their children almost without exception, even in the large cities. And among Europeans the women of previous generations nursed their children much more frequently than the women of the present time.

While many women are disinclined to nurse their children, at least for very long, in these days of artificial substitutes for mother's milk, there is no doubt that a large and increasing proportion are incapable of discharging the normal function of lactation, however much they may desire to do so. It is difficult to discover how far the environment of modern woman is responsible for this change. The fact that the proportion of women unable to nurse their children is usually greater in cities than in rural districts points to the potency of environmental influences. Hereditary defects of lactation would not be eliminated so rapidly as under the régime of primitive life, and it is not improbable that the diminishing action of natural selection in relation to lactation has permitted a certain amount of atrophy of this function.

Inability to nurse children tends to run in families, and, as Bunge and others have shown, it is often associated with parental alcoholism, tuberculosis and a general neuropathic inheritance.

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Bunge[1] concludes as a result of his statistical studies, "if the father is a drinker, the daughter loses the ability to nurse her child, and this ability is irretrievably lost for all future generations. The incapacity to produce milk is no isolated phenomenon. It is coupled with other symptoms of degeneration, especially with lack of resistance to maladies of all sorts, tuberculosis, nervous troubles and dental caries. The children become insufficiently nourished, and the degeneration increases from generation to generation and finally leads, after endless suffering, to the extinction of the strain."

Although other studies have yielded results which are not quite so favorable to Bunge's thesis as are the results of his own investigations, there is a considerable amount of additional data confirming the association of parental alcoholism and defective lactation. The interpretation of this relation, which has been the subject of no little controversy, is rendered more difficult by the influence of social factors, to say nothing of certain sources of statistical error due to the way in which the data are amassed. Bunge's conclusions cannot be said to have received rigid proof, but his investigations justify a strong suspicion that alcohol may have been the cause of diminished lactation and various other defects associated with the atrophy of this function.

Discussions of the racial degeneracy of mankind generally emphasize the alleged increase of insanity, feeble-mindedness and other forms of mental defect. But the question whether mental defect is increasing or decreasing is one which at present cannot be decided with entire certainty. Taking statistics at their face value we should be compelled to conclude that in most civilized countries mental defect is increasing quite rapidly, but our conclusion would rest upon an insecure foundation if we failed to consider probable causes of error in our statistical data.

Let us see what statistics actually teach us: In 1880, according to the U. S. Census Report for that year, there were 40,942 insane in hospitals and asylums in the United States, or 81.6 per

[1] Bunge, G. v., *Die zunehmende Unfähigkeit der Frauen ihre Kinder zu stillen*, 6th ed., Munich, 1909.

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hundred thousand of the population. In 1890 the insane in hospitals were 74,028, or 118.2 per hundred thousand. In 1904 the insane in hospitals had increased to 150,151, or 183.6 per hundred thousand, and in 1910 they had further increased to 187,791, or 204.2 per hundred thousand.

In the census enumerations for 1880 and 1890 an effort was made to ascertain the number of insane not in hospitals. In 1880 the number was estimated at 51,017, or 101.7 per hundred thousand. The census estimate of 1880 made use of cases reported by physicians who returned about 17 per cent of the cases in addition to those discovered by the census officials. This source of information was not made use of in any subsequent census, and this fact accounts in part for the reduced number of cases outside of hospitals appearing in the census report for 1890.

Before 1880 there were no separate enumerations of the insane in hospitals and outside, but general estimates were made of the total number. The numbers per hundred thousand of the population were in 1850, 57.3; in 1860, 76.5; and in 1870, 97.1.

The proportions of mentally deranged persons reported in England and Wales per hundred thousand of the population are shown in the following table:

Number of Insane per 100,000 in England and Wales

1859—186.7	1904—347.1
1869—239.3	1905—350.9
1879—275.4	1906—353.1
1889—296.5	1907—354.8
1899—329.6	1908—366.7

In New Zealand the proportions per hundred thousand were reported as follows:

1886—265.0	1901—344.7
1891—278.2	1906—354.1
1896—311.3	

Ireland shows an increase from 250 per hundred thousand in 1875 to 499 per hundred thousand in 1903, while in Scotland the

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insane increased from 275 per hundred thousand in 1884 to 353 per hundred thousand in 1902, and to about 362 per hundred thousand in 1907. Prussia shows a similar increase; while the population of Prussia increased by one-third between 1875 and 1905, the number of insane in institutions increased fourfold, and in Bavaria with about the same proportionate increase of population the insane in institutions had increased more than threefold.

Other European countries show much the same increase in the reported numbers of the insane. But we cannot conclude that the above statistics constitute a true index of the actual increase of insanity. There are many reasons for believing that the increase of insanity is much less than is indicated by the figures quoted if we grant (which some deny) that insanity has increased at all during recent years.

As facilities for the care of the insane have increased and improved a larger proportion of the insane come to be cared for in institutions. The number who remain scattered through the general population is inaccurately reported, if it is reported at all in the enumerations of the insane. The further back we go, the smaller is the percentage of insane segregated in institutions, and hence the less complete is the enumeration.

Estimates of the proportion of insane in institutions to these outside have been made in Prussia in 1871, 1880, 1895 and 1905. They give the following results:

Proportions of Insane in Institutions in Prussia

1871—21 per cent of all insane
1880—29 " " " " "
1895—53 " " " " "
1905—55 " " " " "

It is probable that much the same situation would be found in most European countries and in the United States; hence the statistics of the rapid increase in the numbers of insane in institutions need not be so disquieting as they at first appear.

A further source of apparent increase of the insane is the fact that, as conditions for the care of these unfortunates im-

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prove, there is a diminution of their death rate, and hence a greater proportion of the insane are found living at any given time. Varying standards as to the degree of mental alienation which may be held to warrant commitment introduce further complications. It is probable that more of the milder forms of insanity are now placed under custodial care than formerly and that more are certified as insane in statistical enumerations. Then it must be borne in mind that the changes in the age composition of the population which have taken place in the last half century, leading to an increasing proportion of adults in which insanity is more likely to develop would of itself produce an increase in the number of insane per 100,000 of the population quite irrespective of any increased proclivity to insanity at any particular period of life. While it is not improbable that, as many alienists believe, insanity has actually been on the increase in recent times, the conclusion cannot be established by the data on the subject which are at present available.

Statistics on feeble-mindedness show that there has been a steady increase in the number of feeble-minded in institutions in proportion to the general population. But one obvious reason for this is the fact that we have more adequate provision than formerly for the institutional care of these unfortunates. As a rule only the lowest grades of the feeble-minded, and by no means all of these, are segregated in institutions. The proportion of feeble-minded in general who are in institutions compared with the number at large in the community is not high. There are indications, as is pointed out elsewhere, that this class is increasing on account of its relatively high birth rate. If our data concerning the relative birth and death rates of the feeble-minded and normal elements of our population were to show that the latter were being outbred by the former, the difference would be sufficiently alarming, even though statistical proof of how fast the feeble-minded are increasing, were lacking.

Some writers have attributed the alleged increase in crime in recent years to the increase in the kind of inheritance that predisposes people to criminal conduct. From what we know

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of the relation of crime to mental defect, it is reasonable to expect that if the latter were to increase, it would tend to make crimes more common. Crime has a sociological as well as a biological and psychological basis, and the variations that occur in the amount of crime at different times and in different countries are correlated in large measure with social, economic, educational and other factors which fluctuate greatly at different times and places. Whether or not most crimes are increasing or decreasing is by no means easy to ascertain. This is especially the case in our own country, owing to the unreliable nature of our statistics.

Homicide, according to the statistical data we possess, has been for several years on the increase in the United States, but it has decreased in most of the countries of Europe. Statistics for different crimes show varying trends, but the general situation in Europe has probably been on the whole improving. That there has been an increasing hereditary predisposition to crime in any country is a conclusion quite unwarranted by any data at present available.

When we consider suicide, however, the evidence points unequivocably to the increase of this crime, if we may call suicide a crime, in nearly all countries of the civilized world. In the United States Mr. Hoffman has found that in 100 of our largest cities the suicide rate had increased from 11.7 per 100,000 in 1890 to 20.3 per 100,000 in 1915. In France the suicide rate has more than trebled since 1830, and in Prussia it has more than doubled. In England and Wales it increased from 77 per million in 1890 to 104 in 1905. There is much variation in the suicide rate in the different countries of Europe, but its increase has been so general and so marked in most countries as to give rise to much speculation as to its probable cause. The growing frequency of suicide is often regarded as connected with the alleged increase of insanity and nervous disorders, and hence as symptomatic of racial deterioration. It is also explained as the results of our changing environment which is commonly held to be productive of more nervous strain than in previous years. Race, religion, economic pressure, health and various other circumstances profoundly

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affect the disposition to suicide, so that it is not safe to ascribe the increasing suicide rate mainly to our deteriorating inheritance, although it is not improbable that the latter factor is one of importance. Many families have been described in which there has been a strong and apparently hereditary bent toward suicide. But from the nature of the case it is scarcely feasible to compare the relative strength of nature and nurture in leading people to end their lives.

A number of writers who have discussed the possible degeneracy of the human species have derived much comfort from the decreasing death rate and the increasing average duration of life. W. Kruse, for instance, in a long article on this theme (*Entartung*, Zeit. soz. Wiss., 6, 359 and 411, 1903) comments on the decreasing death rate of Germany and upon the decreasing morbidity of the German army, after which he exclaims "Wo bleibt da die Degeneration?" This rather naïve performance really contributes very little to the solution of the problem. Mortality and morbidity have been so profoundly affected by advances in hygiene that they would be bound to decrease, even in face of an extensive deterioration in native vigor.

The problem of the alleged increase of degenerative diseases has elicited a good deal of discussion and opinion in the subject is still much divided. In a paper on *The Increasing Mortality from Degenerative Maladies*[1] by E. E. Rittenhouse of the Equitable Life Insurance Society of the United States it is claimed that the mortality from such diseases is becoming greater for all ages of life, although it is relatively higher for the advanced age periods. "In sixteen cities the mortality rate from heart, apoplexy and kidney affections alone has increased in thirty years from 17.94 to 34.78, or 94 per cent; during ten years (1900–1910) it increased from 29.4 to 36.78, or 18 per cent. In New Jersey (1880–1910) it increased from 16.5 to 34.3, or 108 per cent." It is shown that the death rate in advanced ages over 45–54 has increased in these same cities and also in Massachusetts and New Jersey, and probably in other cities and states with less adequate statistics.

[1] *Pop. Sci. Mon.* 82, pp. 376–380, 1913.

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The death rate of the total population aged 40 and over has increased in Massachusetts and New Jersey during 30 years (1880–1910) 5.3 or 21.2 per cent, in 16 cities 8.1 or 25.3 per cent, and in 10 states from 1900–1910, 89 or 3 per cent. The author concludes that "while the average length of life has advanced, the extreme span of life has not done so—in fact, the indications are that is has been shortened."

These are disquieting statistics, but we must be careful in interpreting them. As Dublin has pointed out, the increasing mortality after middle age in this country may be largely explained by the increasing proportions of foreigners and their immediate descendants, among whom the average expectation of life is considerably lower than among the native population of native parentage. As an inspection of Glover's life tables will show, the differences in the mortality rates of the native and the foreign born become greater with advanced ages, although they have become reduced in extreme age. That the decreasing longevity in advanced age groups is not a general characteristic of modern civilization as indicated by a comparison of the life tables of several countries of Europe. Taking the expectation of life at sixty years as an index of vitality in old age we find in France a slight increase from 1861–65, when it was 13.55 years, to 13.58 years in 1877–81, and a further increase in 1898–03 to 13.81 years. The increased expectation of life at sixty years in Germany is shown as follows:

Expectation of Life in Germany at 60 Years of Age

Dates	*1871–81*	*1881–90*	*1891–00*	*1901–10*
Expected years of life.....	12.11	12.43	12.82	13.14

Denmark shows a steadily increasing expectation of life at sixty years from 1835–44 to 1900 and Norway shows a gradual increase since 1856 and Sweden since 1861. The expectation of life at sixty years in England fell somewhat from the middle of the 19th century to 1881–90 after which it has increased about two years. For the past thirty to forty years people of the old-age groups have been living slightly longer on the average also in

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Australia. In the more advanced ages the expected duration of life has shown a smaller amount of increase, but in a number of countries even the man of eighty may count on living a little longer than he would a few decades ago.

The increase in the degenerative diseases of later life in the United States is probably due, to a considerable extent, to the increase of our foreign stocks which show a strong tendency to segregate in cities where they live under conditions which frequently dispose them to an early break down. It is a debatable question, especially in view of the varying categories of the diagnosis of disease, whether degenerative diseases are on the increase in the civilized world, and it is further a matter of uncertainty how far our industrial development and increasing urban life may tend to accelerate the development of these afflictions.

The most discussed problem in relation to the increase of degenerative diseases is that of the alleged increase of cancer. The problem is of particular importance since cancer ranks very high among the causes of death in adults, especially those of over 45 years of age. Many medical writers have become convinced that cancer is on the increase. Certainly the mortality statistics of most civilized countries attribute an ever increasing proportion of deaths to this cause. Taking the statistics of cancer mortality for Massachusetts, for instance, we find the following:

Proportions of Deaths from Cancer in Massachusetts

Years	*Cancer Death Rate per 100,000*
1856–60	23.3
1866–70	32.8
1876–80	45.1
1886–90	59.2
1896–90	69.2
1906–10	86.9
1911	92.6
1912	94.0
1913	99.4

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Without citing similar statistics which may be derived from other states and most countries of the globe, it may be asked if these data really suffice to prove that cancer is actually increasing. In interpreting most statistics of the increase of cancer allowance must be made for the changing age distribution of the population. Both the decline of the birth rate and the increasing duration of life make the proportion of people of middle age and beyond relatively higher. Hence a larger proportion of the population would now be liable to be affected by cancer than in previous years.

Undoubtedly this circumstance explains a part of the statistical increase of cancer, but it does not suffice to explain all of it. Willcox in fact attributes only about one-third of the reported increase to this cause. If we study the death rate for any particular age, say 55, estimating the proportion dying of cancer to all the population of that age we frequently find that the cancer death rate has increased materially in the last few years. This is true for most ages in the United States between the periods 1903–07 and 1908–12 according to the United States Census. Data from the life insurance companies of Austria over the period from 1876 to 1900 fail to show any consistent trend of cancer mortality for most age groups.

Dr. F. L. Hoffmann on the basis of his extensive and valuable collection of statistics on cancer mortality from several countries has concluded that there is an actual increase of cancer which cannot be explained either by changes in age distribution of the population or by improvements in the accuracy of diagnosis. Professor Willcox, however, has made a critical study of the problem and has come to a quite different conclusion. Most of the statistical increase of cancer which cannot be explained by the increasing proportion of people of middle or old age may be accounted for, according to Willcox, by improvements in diagnosis and the greater proportion of deaths which are now certified by competent physicians. The layman seldom reports cancer as a cause of death. Where physicians are relatively plentiful more deaths from cancer are put on record. Fewer deaths are now

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attributed to old age, and the deaths ascribed to "unknown causes" in the American registration states had decreased in 1915 to less than one-tenth of the number reported in 1900. In the same area and period the deaths from "tumor" had decreased to about one-fourth of their previous figure. It is evident that many deaths removed from these categories help to swell the cancer death rate.

King and Newsholme, as a result of their studies of the cancer statistics of Frankfort-on-the-Main, came to the conclusion in 1893 that "the increase in cancer is only apparent and not real, and is due to improvement in diagnosis and more careful certification of the causes of death. This is shown by the fact that the whole of the increase has taken place in inaccessible cancer difficult of diagnosis, while accessible cancer easily diagnosed has remained practically stationary." Willcox made a further study of the Frankfort statistics for the period between 1890 and 1913, thereby gaining access to a much larger amount of material (over 9,000 deaths) than that studied by King and Newsholme. He found, in agreement with these authors, that the reported increase of cancer was due to cancers located in inaccessible parts, the death rate from accessible cancer showing no general increase since the beginning of the original investigation in 1860. He points out that in England and the United States the death rate from appendicitis, despite much successful surgery, has increased almost as much as the death rate from cancer, owing probably to the fact that appendicitis was formerly diagnosed as some other malady. The conclusion of Prof. Willcox's careful analysis of the problem is that "The cumulative evidence that improvements in diagnosis and changes in age composition explain away more than half and perhaps all of the apparent increase in cancer mortality rebuts the presumption raised by the figures and makes it probable, although far from certain, that cancer mortality is not increasing."

Our available data on the recent changes which have occurred in the physical or mental characteristics of the race, are, I believe, insufficient to afford any positive proof of decadence. Even if

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differential fecundity it now helps to maintain is mainly in favor of elements which, for the most part, have not demonstrated a superior inheritance. The manifold racial effects of industrial development are in many respects bad. Industry may intensify the action of natural selection in eliminating persons whose physique and intelligence are below the general level, but, on the other hand, its influence on differential fecundity may more than counteract its tendency to racial improvement. Its effect in encouraging celibacy in increasing numbers of capable and self-reliant women who qualify themselves for an economically independent career promises to be a serious racial danger. Education itself, the basis of so much of our advancement, has proven, up to the present, a dysgenic agency. Its devotees commonly fail to reproduce themselves, and since education is becoming extended to more and more of those who are capable of acquiring it the racial damage thus caused is correspondingly increased.

The effect of our modern life upon the trend of germinal variability, is as we have pointed out before, a subject about which we know little. Alcoholism while helping to dispose of a number of undesirables, is open to grave suspicion as a cause of defective inheritance. The same suspicion may reasonably be entertained concerning a number of other unfavorable influences which now affect a large proportion of humanity, in so far as these involve the toxic action of drugs, diseases or bad air.

When we attempt to gain a comprehensive view of the forces which are changing human inheritance it becomes apparent that those forces which have been called into action as a result of the development of our culture are in large part racially destructive. We cannot say that they are entirely so because there are counter tendencies which sometimes arise. All those agencies which bring about the present well-marked correlation between sterility and success in life tend to rob the race of its best inheritance. It is chiefly the primitive evolutionary factors which operate among the lower animals that are making for racial improvement in man. Civilization brings in its train so many factors that undermine its own biological foundations that, from the racial standpoint

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For most civilized countries, therefore, the necessity for further restriction of the birth rate must sooner or later become imperative. If this should occur mainly in people of better endowments who already have a low birth rate the deterioration of our racial inheritance will go on at an accelerated pace.

The birth rate of different stocks would become more nearly equalized by economic reforms which would effect a more equitable distribution of wealth and by the greater diffusion of education which would be favored by such reforms. An ignorant and poverty-ridden proletariat will multiply rapidly through sheer lack of restraint. It is a most fortunate circumstance that the third estate continues to include many people of excellent hereditary qualities; in course of time, however, they tend to rise and become sterile, and thus the great breeding ground from which they emerged is impoverished. It is the very inadequancy and incompleteness of this sifting process which has thus far tended to keep racial deterioration in check. A social system in which human beings are rewarded by education and position according to their inborn capacity has often been held up as a desideratum. But lest the racial effect of such a régime should prove to be more destructive than our present system, some means must be instituted for encouraging race suicide among those to whom Nature has been grudging in her distribution of desirable endowments.

It is doubtless feasible to do much through education toward the accomplishment of this purpose, but the advantages conferred by elimination, however extensively it may be carried out, are of less value than those resulting from an increase in the highest types of inheritance. The best blood of a nation is its most priceless possession. It cannot be increased by any artificial or arbitrary methods as these would not commend themselves to modern ethical standards. Education to whose influence many dysgenic effects may now be justly charged is, after all, the essential basis for the realization of any project of racial improvement. To be effective it must include the inculcation of a sense of responsibility for the hereditary qualities of future generations.

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Education is eugenically of value as making possible the development of a "eugenic conscience" which is now sadly lacking in most people of culture. It is a hopeful sign that here and there among people who have inherited a generous measure of desirable traits eugenic considerations have led to the rearing of larger families. On the other hand, many who are aware that they carry a hereditary taint refrain from transmitting a possible affliction to their posterity. With a higher standard of education and a diffusion of the sense of obligation to transmit socially valuable qualities conditions might conceivably be changed so that a greater relative fecundity would come to characterize the more vigorous, intelligent and public-spirited members of the community. Those who have been most fortunate in the possession of hereditary gifts should feel that upon them rests an unusual obligation to see that their qualities are not allowed to perish from the earth. The race has its fate in its own hands to make or to mar. Will it ever take itself in hand and shape its own destiny?

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